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Bioventing Pilot Test Work Plan for Spill Site No. 1, Building 457 Area, and UST 702

Eaker Air Force Base
Blytheville, Arkansas

Prepared For

Air Force Center for Environmental Excellence
Brooks Air Force Base, Texas

and

Air Force Base Conversion Agency/OL-J
Eaker Air Force Base, Arkansas

February 1996

PARSONS
ENGINEERING SCIENCE, INC.
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BIOVENTING PILOT TEST WORK PLAN FOR SPILL SITE NO. 1, BUILDING 457 AREA, AND UST 702

EAKER AIR FORCE BASE
BLYTHEVILLE, ARKANSAS

Prepared for:

Air Force Center for Environmental Excellence
Brooks AFB, Texas

and

Air Force Base Conversion Agency/OL-J
Eaker AFB, Arkansas

February 1996

Prepared by:

Parsons Engineering Science, Inc.
1700 Broadway, Suite 900
Denver, Colorado 80290

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DRAFT

BIOVENTING PILOT TEST WORK PLAN FOR SPILL SITE NO. 1, BUILDING 457 AREA, AND UST 702 EAKER AIR FORCE BASE BLYTHEVILLE, ARKANSAS

1.0 INTRODUCTION

This work plan presents the scope of a multiphase bioventing pilot test for *in situ* treatment of fuel-contaminated soils at Spill Site No. 1, Building 457 Area, and underground storage tank (UST) 702, at Eaker Air Force Base (AFB) (the Base), near the city of Blytheville, Arkansas. The pilot test will be performed by Parsons Engineering Science, Inc. (Parsons ES) [formerly Engineering-Science, Inc. (ES)]. The primary objectives of the proposed pilot tests are: 1) to assess the potential for supplying oxygen throughout the contaminated soil interval; 2) to determine the rate at which indigenous microorganisms will degrade fuel when supplied with oxygen-rich soil gas; 3) to evaluate the potential for sustaining these rates of biodegradation until fuel contamination is remediated to concentrations below regulatory standards; and 4) to determine design parameters, such as well spacing and flow rates, for full-scale bioventing system design.

The pilot tests will be conducted in three phases. The initial phase will consist of investigative drilling with a Geoprobe® truck-mounted direct-push sampling rig, soil sampling, and vapor monitoring point (MP) installation at each site. Up to five vapor MPs will be installed with the Geoprobe® rig at each site. The second phase will consist of construction of up to two air injection vent wells (VWs), and conducting an *in situ* respiration test and an air permeability test at each site. Existing groundwater monitoring wells may be used as VWs or additional vapor MPs if their screens extend above the saturated zone. Proposed VW and MP boring locations will be sampled and field screened for volatile organic compounds (VOCs) (using a photoionization detector [PID] and a total volatile hydrocarbon analyzer [TVHA]), prior to the final installation. This initial testing is expected to take approximately 3 weeks. During the last phase, the bioventing systems will be operated and monitored for a 1-year period. At the end of this period, soil gas sampling and respiration testing will be performed to determine the level of cleanup achieved after 1 year of treatment.

An initial pilot test results report will be prepared following completion of the initial phase of testing. This report will summarize the test results and make specific recommendations for continued system operation and/or expansion at each site. If the initial phase of testing proves bioventing to be an effective means of remediating soil

contamination, pilot test data will be used to prepare a conceptual full-scale system design and cost estimate, and to estimate the time required for site cleanup. At the end of the 1-year testing phase, a letter report will be prepared to summarize long-term testing results. Additional background information on the development and recent success of bioventing technology is presented in the protocol document entitled *Test Plan and Technical Protocol for a Field Treatability Test for Bioventing* (Hinchee *et al.*, 1992). This protocol document will serve as the primary reference for pilot test well designs and the detailed procedures to be used during the tests.

This work plan was developed following discussions among representatives from the Air Force Center for Environmental Excellence (AFCEE), Eaker Air Force Base Conversion Agency (AFBCA), and Parsons ES at a meeting held at the Base on November 16, 1995, the statement of work (SOW) for this project (US Air Force, 1994), and on a review of existing site characterization data. All the field work will follow the health and safety procedures presented in the program Health and Safety Plan for Extended Bioventing (Parsons ES, 1995), and the site-specific addendum to the program Health and Safety Plan. This work plan was prepared for AFCEE and AFBCA.

2.0 SITE DESCRIPTION

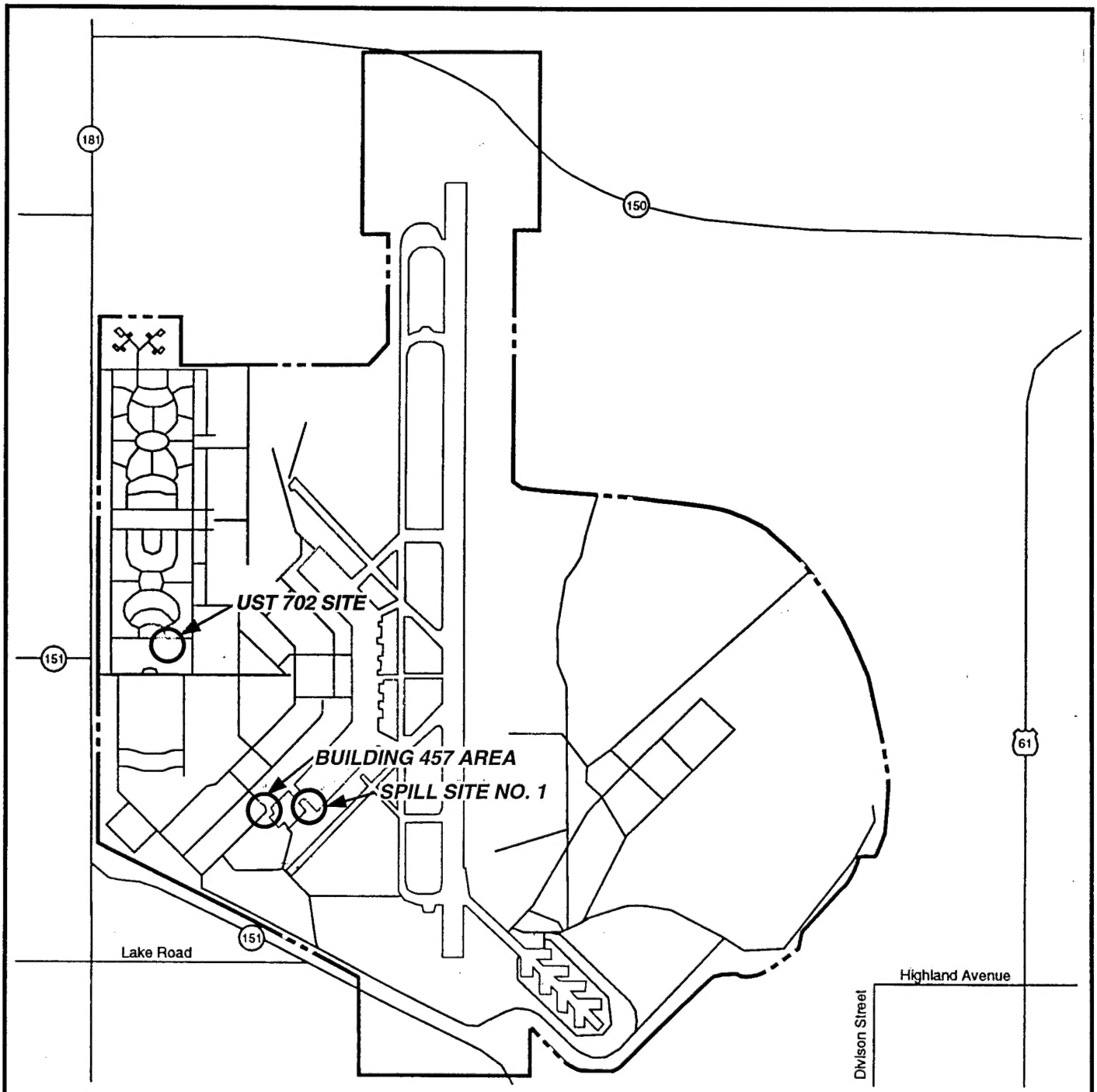
2.1 Spill Site No. 1

2.1.1 Site Location and History

Spill Site No. 1 is located near former Pumphouse No. 4 (Building 1020), between Pumphouse No. 2 (Building 1235) and the southeastern terminus of the flight apron. The site location relative to the Base is shown on Figure 2.1. Four 50,000-gallon underground storage tanks (USTs) containing jet propulsion fuel grade 4 (JP-4) were formerly located northeast and northwest of Pumphouse No. 4. The site layout is shown in Figure 2.2. Ten-inch and 6-inch pipelines were used to transfer fuel from the four tanks to the aircraft fueling hydrants on the flight apron. Pressure testing of the fuel hydrant system, performed in 1973, indicated the presence of a leak in the 6-inch fuel line, northwest of Pumphouse No. 4 (HNUS, 1994). During the subsequent pipeline repair, petroleum-contaminated soils were observed in the shallow excavation. The time-frame and amount of fuel released are unknown. The site is currently vacant and inactive.

2.1.2 Site Geology and Hydrology

Because bioventing technology is applied to unsaturated soils, this section will only discuss soils above the shallow aquifer. Subsurface soils at Spill Site No. 1 primarily consist of silty clay materials with interbedded sandy lenses to a depth of approximately 10.5 feet below ground surface (bgs). The proposed bioventing site is covered with grass. Groundwater was encountered at a depth of approximately 10 to 13 feet bgs during September 1995; however, seasonal fluctuations vary (HNUS, 1995a).



Source: US Air Force, 1995.

FIGURE 2.1

SITE LOCATIONS WITH RESPECT TO BASE

Eaker AFB, Arkansas

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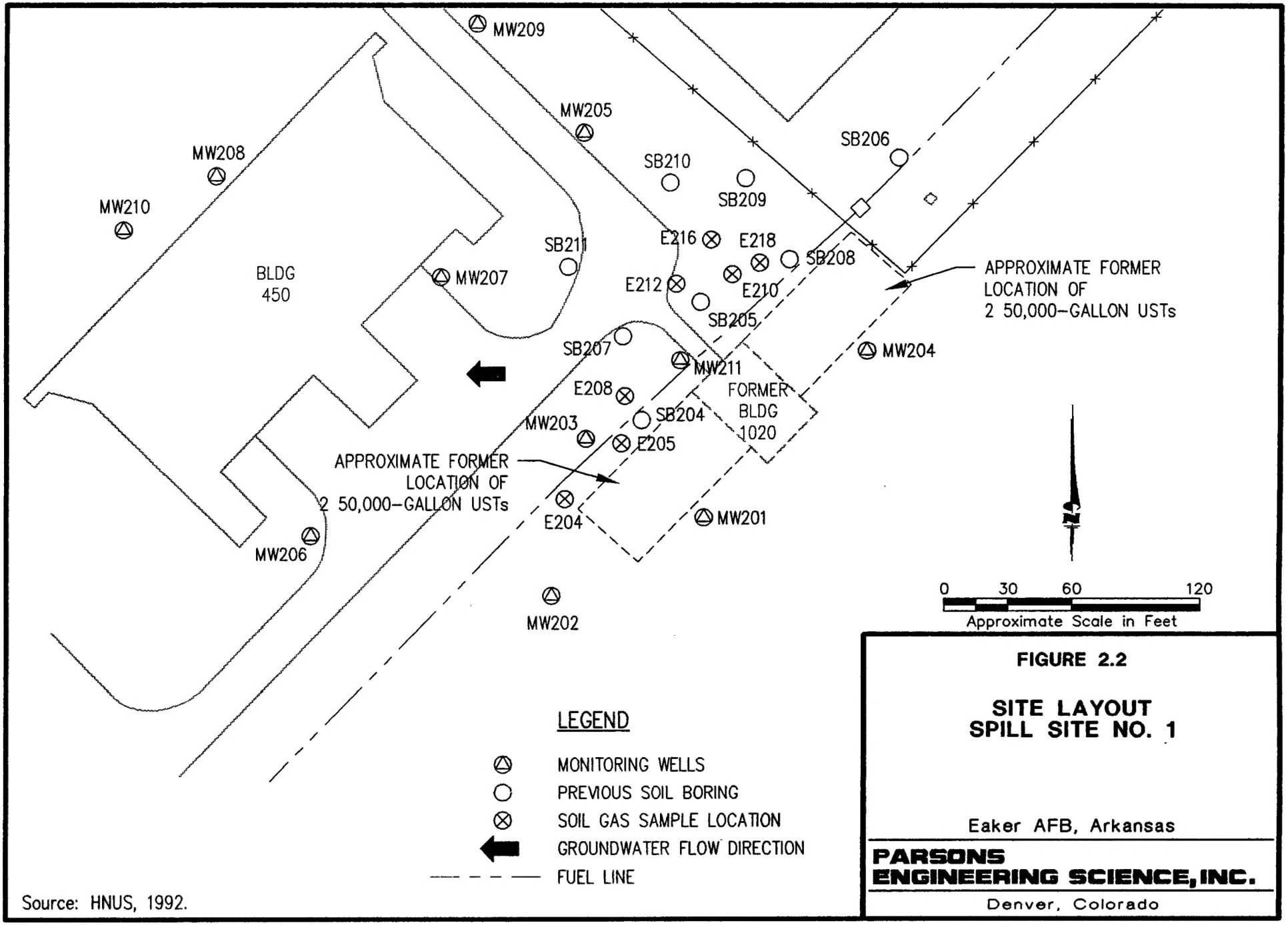

FIGURE 2.2

SITE LAYOUT
SPILL SITE NO. 1

Eaker AFB, Arkansas

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2.1.3 Site Contaminants

The primary contaminants at this site are JP-4 petroleum hydrocarbons, which have been detected in the soils. The source of the fuel contamination was the leaking transfer pipeline. The highest concentrations of petroleum hydrocarbons in soils are found west, north, and northwest of Pumphouse No. 4 (Building 1020). The highest concentrations of organic compounds were found in "smear zone" soils near the water table in boreholes SB204, SB207, and SB208 (Figure 2.2). Total petroleum hydrocarbons (TPH) were detected at 9,500 milligrams per kilogram (mg/kg), and total benzene, toluene, ethylbenzene, and xylenes (BTEX) were detected at 295.2 mg/kg in soil boring SB208 at a depth of 9 feet bgs (HNUS, 1994). Soil borehole SB204 contained 5,200 mg/kg of TPH and no BTEX at a depth of 6 to 7 feet bgs. Vadose zone soil contamination appears to be confined to the area between and adjacent to soil borings SB209 (north), and SB211 (west), monitoring well MW202 (south), and former Pumphouse No. 4 (Building 1020). The extent of contaminant migration in the smear zone along the water table may have been limited by site conditions (i.e., natural attenuation, low permeability aquifer), because TPH and BTEX compounds were not detected in significant concentrations downgradient from the site (wells MW205, MW206, and MW207) (HNUS, 1994).

Parsons ES conducted an initial soil gas survey of existing monitoring wells at Spill Site No. 1 in November 1995. Table 2.1 presents the results of the soil gas survey. Low oxygen concentrations measured at monitoring wells MW203 and MW207 indicate that without the benefit of air injection, natural biodegradation of JP-4 compounds may be limited. Additionally, monitoring well MW211 had a total volatile petroleum hydrocarbon (TVH) concentration of greater than 10,000 parts per million, volume per volume (ppmv). MW211 is screened partially across clean soils so high levels of oxygen in the soil gas is not surprising (Table 2.1). This survey confirmed that aerobic fuel biodegradation is occurring in contaminated soils, and that bioventing may be a feasible remediation technology at this site.

2.2 Building 457 Area

2.2.1 Site Location and History

Building 457 is located west of Spill Site No. 1 (Figure 2.1), and was formerly used as a fuel cell maintenance and repair shop (US Air Force, 1995). A 20,074-gallon steel UST used to store fuel oil, located at the northwest corner Building 457, was removed in August 1994 (US Air Force, 1995). The site layout is shown in Figure 2.3. Analytical results of soil samples taken from the sidewalls of the excavation pit indicated that all contaminated soil had not been removed (US Air Force, 1995). The excavated soil is being landfarmed on base. The excavation was backfilled with treated soil from the landfarm (Looney, 1996).

UST Area 410 is located approximately 200 feet southwest of Building 457, near the above-mentioned tank site. In the 1940s, 12 25,000-gallon USTs were installed and used for aviation fuel storage until the mid-1950s (Figure 2.3). Four of the tanks were removed in 1988, and the other eight were removed in November, 1995 (Looney,

TABLE 2.1
INITIAL SOIL GAS CHEMISTRY
SPILL SITE NO. 1
EAKER AFB, ARKANSAS

Sample Location	Screen Depth (feet bgs) [a/]	O_2 (%)	CO_2 (%)	Field TVH (ppmv) [b/]
MW201	7-22	9.1	8.0	1,000
MW202	6.6-21.6	8.5	4.3	4,800
MW203	6-21	4.2	11.2	>10,000
MW204	NA [c/]	19.8	1.6	150
MW207	11.6-21.6	0.0	12.0	6,000
MW211	9-19	18.9	2.3	>10,000

[a/] bgs = below ground surface.

[b/] Total volatile hydrocarbon field screening results reported in parts per million, volume per volume.

[c/] NA= not available.

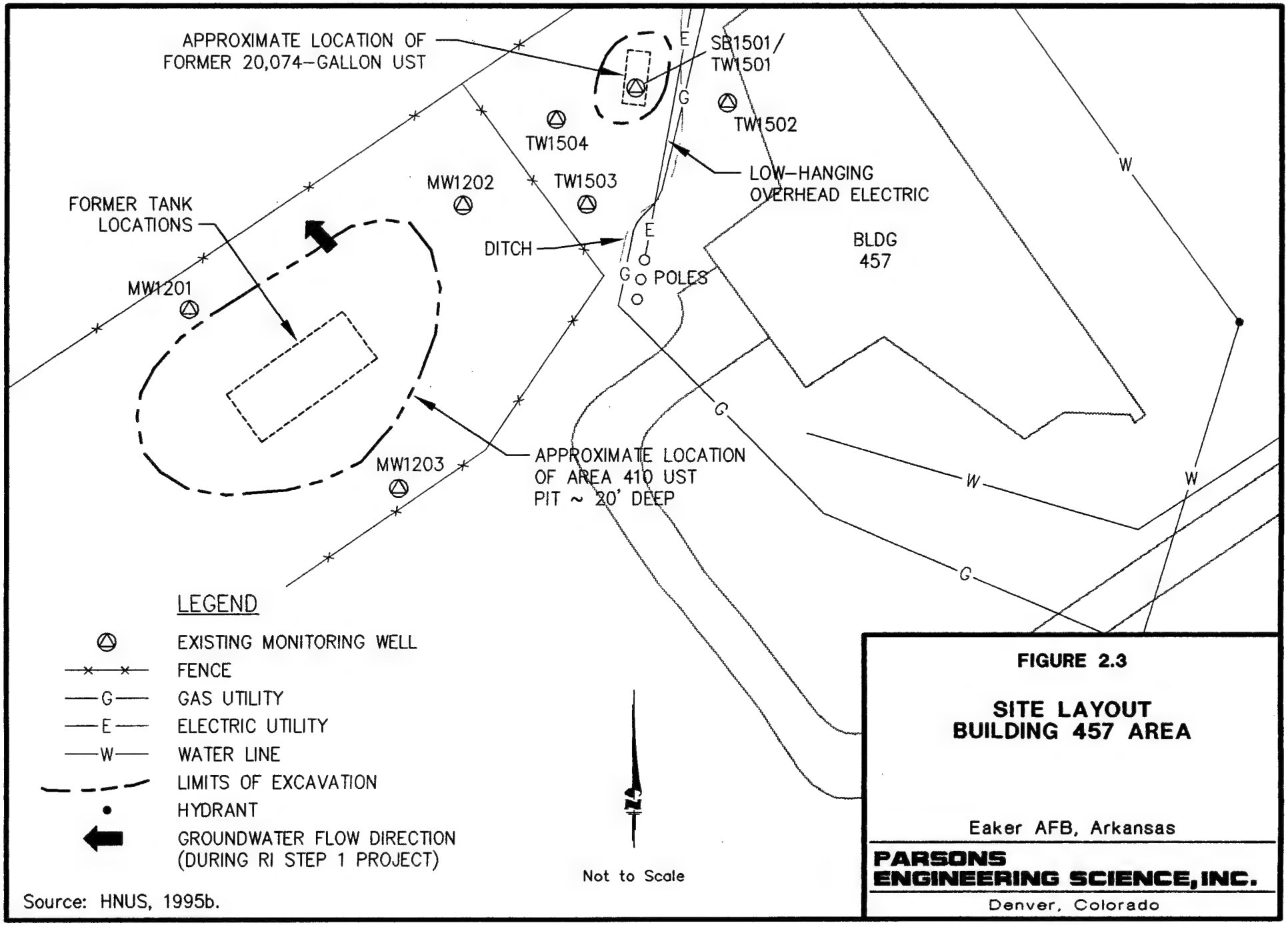

FIGURE 2.3

SITE LAYOUT
BUILDING 457 AREA

Eaker AFB, Arkansas

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Denver, Colorado

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1996). Approximately 4,500 cubic yards of contaminated soil was excavated and is being treated at a Base soil landfarm; however, some smear zone contamination above state soil cleanup levels for TPH is anticipated. The excavation pit was backfilled with treated soil from the landfarm (Looney, 1996).

2.2.2 Site Geology and Hydrology

Subsurface soils at the Building 457 Area are similar to those at Spill Site No. 1; primarily consisting of silty clay materials with interbedded sandy lenses to a depth of 12 feet bgs. Groundwater is encountered at a depth of approximately 3.5 to 9.5 feet bgs, and flows to the northwest or southwest, depending on seasonal variations (HNUS, 1995a).

2.2.3 Site Contaminants

The primary contaminants near Building 457 are petroleum hydrocarbons, which have been detected in the soils and groundwater. The sources of vadose zone contamination near Building 457 and Area 410 were UST leaks at the respective areas. The highest concentrations of organics at the Building 457 UST site were found in samples collected at the south and east excavation walls. TPH were detected at concentrations of 1,400 mg/kg and 4,700 mg/kg at a depth of 12 feet bgs at the east and south locations, respectively. TPH analytical results from samples from the north and west excavation walls were non-detects (US Air Force, 1995). Based on soil headspace readings and analytical results from the monitoring wells, it appears that vadose zone soil contamination is confined to the area immediately adjacent to the tank excavation.

Parsons ES conducted an initial soil gas survey of existing monitoring wells at the Building 457 tank site. Table 2.2 presents the results of the soil gas survey. Low oxygen concentrations measured at monitoring wells TW1501 and TW1503 (Figure 2.3) indicate that without the benefit of air injection, natural biodegradation of fuel compounds may be limited. The majority of petroleum hydrocarbon contamination at the site appears to be in the smear zone.

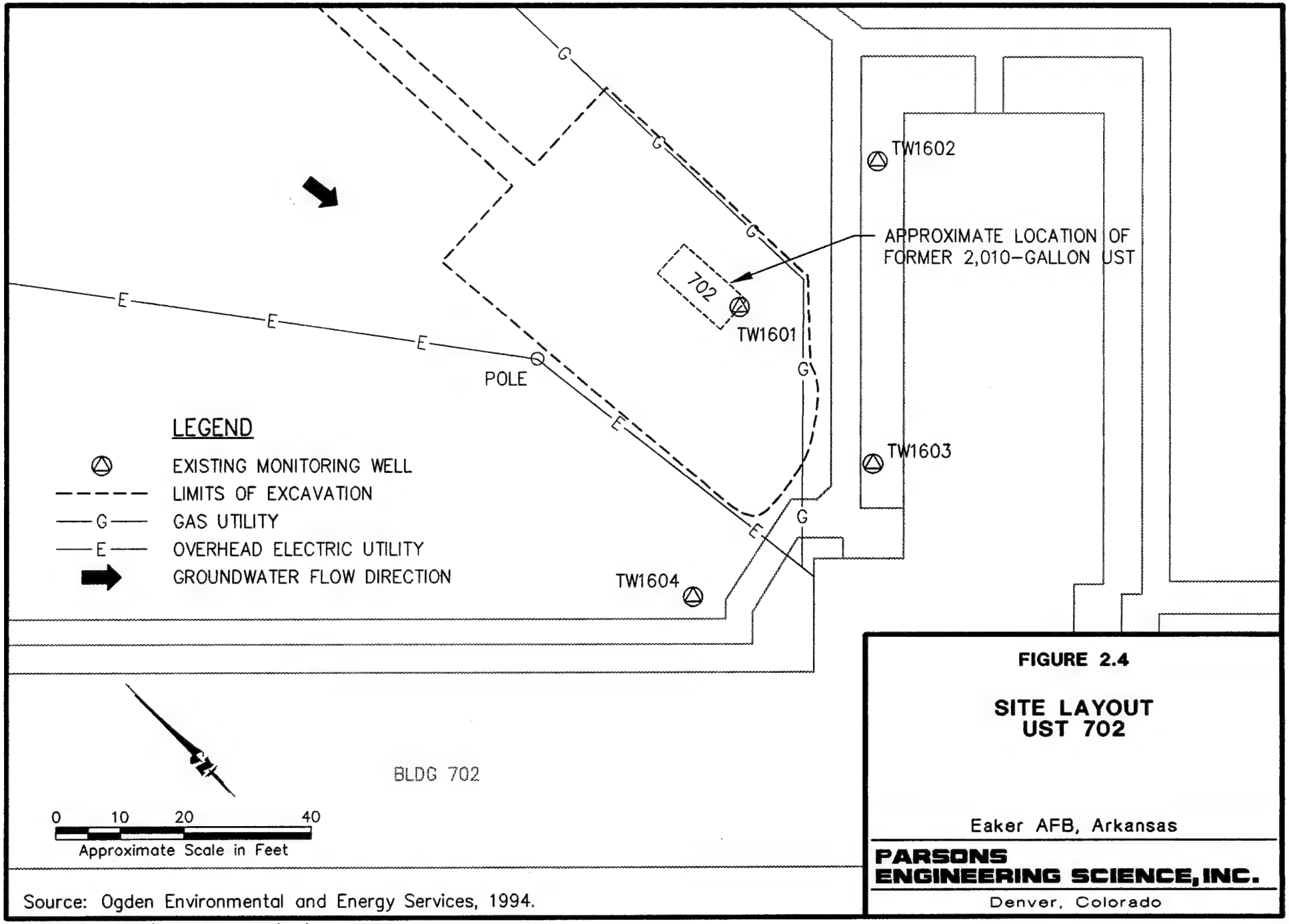
Most of the contaminated soils at the 410 Area have been excavated. A soil gas survey conducted in 1995 for HNUS indicates that soils upgradient from the excavation are relatively clean; however, because the survey did not encompass the downgradient (northwest) side, site conditions are not fully characterized. During bioventing activities at the Building 457 UST site, a soil gas survey will be conducted at monitoring wells MW1201, MW1202, and MW1203 at the 410 Area (Figure 2.3) to determine if oxygen levels are sufficient to sustain microbial activity. Should 410 Area site conditions require bioventing, the pilot test system at Building 457 UST site may be expanded to include the 410 Area.

TABLE 2.2
INITIAL SOIL GAS CHEMISTRY
BUILDING 457 AREA
EAKER AFB, ARKANSAS

Sample Location	Screen Depth (feet bgs) [a/]	O_2 (%)	CO_2 (%)	Field TVH (ppmv) [b/]
TW1501	6-16	3.0	10.3	70
TW1502	8-18	9.5	7.3	94
TW1503	5.5-15.5	2.0	7.1	960
TW1504	5.5-15.5	7.9	5.9	140

[a/] bgs = below ground surface.

[b/] Total volatile hydrocarbon field screening results reported in parts per million, volume per volume.



Source: Ogden Environmental and Energy Services, 1994.

FIGURE 2.4

SITE LAYOUT
UST 702

Eaker AFB, Arkansas

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2.3 UST 702

2.3.1 Site Location and History

Former UST 702 was located adjacent to Building 702 in the west central portion of the Base (Figure 2.1). The site layout is shown in Figure 2.4. The former 2,010-gallon tank, used to store fuel oil that was used for heating Building 702, was removed in June 1994. Although the tank was over excavated, tank removal soil sampling results confirmed that not all contaminated soil had been removed from the site (US Air Force, 1995). The excavation has since been backfilled with treated soil from the onsite landfarm (Looney, 1996). The site is currently vacant and inactive.

2.3.2 Site Geology and Hydrology

Subsurface soils near former UST 702 primarily consist of silt and sand from ground surface to 12 feet bgs, and silty clay materials at a depth of 12 to 16 feet bgs. Groundwater was encountered at a depth of approximately 8 to 9 feet bgs during September 1995 (HNUS, 1995b).

2.3.3 Site Contaminants

The primary contaminants at this site are petroleum hydrocarbons, which have been detected in the soils. Soil samples collected during the tank removal activities indicate that the highest concentrations of petroleum hydrocarbons in soils were detected at the southern edge of the tank excavation. TPH were detected at the south wall (12,000 mg/kg), east wall (6,100 mg/kg), and west wall (3,100 mg/kg) at a depth of 17 feet bgs (US Air Force, 1995). The majority of petroleum hydrocarbon contamination at the site appears to be in the smear zone. Soil sample analytical results from samples collected during the monitoring well installation, indicate that the extent of contamination is limited to the area adjacent to the former tank excavation (HNUS, 1995b). No BTEX samples have been collected to date.

Parsons ES conducted an initial soil gas survey of existing monitoring wells at the UST 702 site. Table 2.3 presents the results of the soil gas survey. Low oxygen concentrations measured at monitoring well TW1601 (Figure 2.4) indicate that without the benefit of air injection, natural biodegradation of fuel hydrocarbons may be limited.

3.0 PILOT TEST ACTIVITIES

The purpose of this section is to describe the pilot test activities proposed for Spill Site No. 1, Building 457 Area, and UST 702. The proposed locations and construction details for the VWs and vapor MPs are discussed. Where appropriate, an existing monitoring well may be used as a VW. Existing monitoring wells that are installed in clean soils will be used as background MPs. Soil and soil gas sampling procedures and the blower configuration that will be used to inject air (oxygen) into contaminated soils also are discussed in this section. Finally, a brief description of the pilot test procedures is provided.

TABLE 2.3
INITIAL SOIL GAS CHEMISTRY
UST 702
EAKER AFB, ARKANSAS

Sample Location	Screen Depth (feet bgs) [a/]	O_2 (%)	CO_2 (%)	Field TVH (ppmv) [b/]
TW1601	6-16	1.1	11.0	88
TW1602	6-16	20.7	0.4	40
TW1603	6-16	20.8	0.05	0
TW1604	6-16	20.8	0.05	3

[a/] bgs = below ground surface.

[b/] Total volatile hydrocarbon field screening results reported in parts per million, volume per volume.

The bioventing technology is intended to remediate contamination only in the unsaturated zone. Therefore, pilot test activities will be confined mainly to unsaturated soils. Prior to installation of the VWs and vapor MPs at each site, the anticipated VW and MP borehole locations will be presampled with a Geoprobe® truck-mounted hydraulic direct-push rig. The locations will be sampled continuously from approximately 3 feet bgs to 1 foot below the groundwater surface and screened for VOCs with a PID and a THVA. Before abandoning the Geoprobe® boreholes, the site engineer will identify the boreholes to be used as vapor MPs. Typically, multiple-depth vapor MPs are preferred; however, considering the shallow groundwater table at Eaker AFB, only single-depth vapor MPs may be installed in most cases. The MPs will be installed in select Geoprobe® boreholes, within the most contaminated unsaturated interval as indicated by field screening for VOCs. If subsequent soil gas sampling of the newly installed MPs at Building 457 Area and UST 702 reveals sufficient oxygen concentrations (>15%) in native soils adjacent to the excavation, then a VW will be installed in the center of the tank excavation. If significant vadose zone petroleum contamination is encountered in native soils adjacent to the excavation, conceptually, a vent well(s) will be installed approximately 10 to 15 feet from the excavation. Additionally, selected existing monitoring wells that are not used as VWs will be used as vapor MPs. No dewatering will take place during the pilot tests.

3.1 Test Design for Spill Site No. 1

A general description of criteria for siting VWs and vapor MPs is included in the protocol document (Hinchee *et al.*, 1992). Figure 3.1 illustrates the proposed locations of the three VWs (including two existing monitoring wells to be used as VWs) and five MPs at Spill Site No.1. Review of the construction details of the existing groundwater monitoring wells (Appendix A) indicated that monitoring wells MW203 and MW211 are suitable for use as VWs or as vapor MPs. Conceptually, it is anticipated that air will be injected into monitoring wells MW203 and MW211, and the one proposed additional VW. The final location of the additional VW may vary slightly from the proposed location shown on Figure 3.1 if significant fuel contamination is not observed in the Geoprobe® borehole. Soils in this area are TPH-contaminated and oxygen-depleted (< 2 percent), and biological activity should, therefore, be stimulated by oxygen-rich soil gas ventilation during pilot test operations.

Because of the low-permeability soils in fuel-contaminated regions, fine-grained soils near the surface (which reduce airflow to the surface), and Parsons ES's experience with similar soil types, the potential radius of venting influence around the VWs is expected to be 30 feet. Five vapor MPs (MPA, MPB, MPC, MPD, and MPE) will be located within a 30-foot radius of the VWs (Figure 3.1).

3.1.1 Vent Well Installation

The additional VW will be constructed of 4-inch-diameter Schedule 40 polyvinyl chloride (PVC) casing, with an estimated 10-foot interval of 0.04-inch slotted screen set at 5 to 15 feet bgs. Flush-threaded PVC casing and screen with no organic solvents or glues will be used. The filter pack will be clean, well-rounded silica sand with a 6-9 grain size, which will be placed in the annular space to 1 foot above the screened

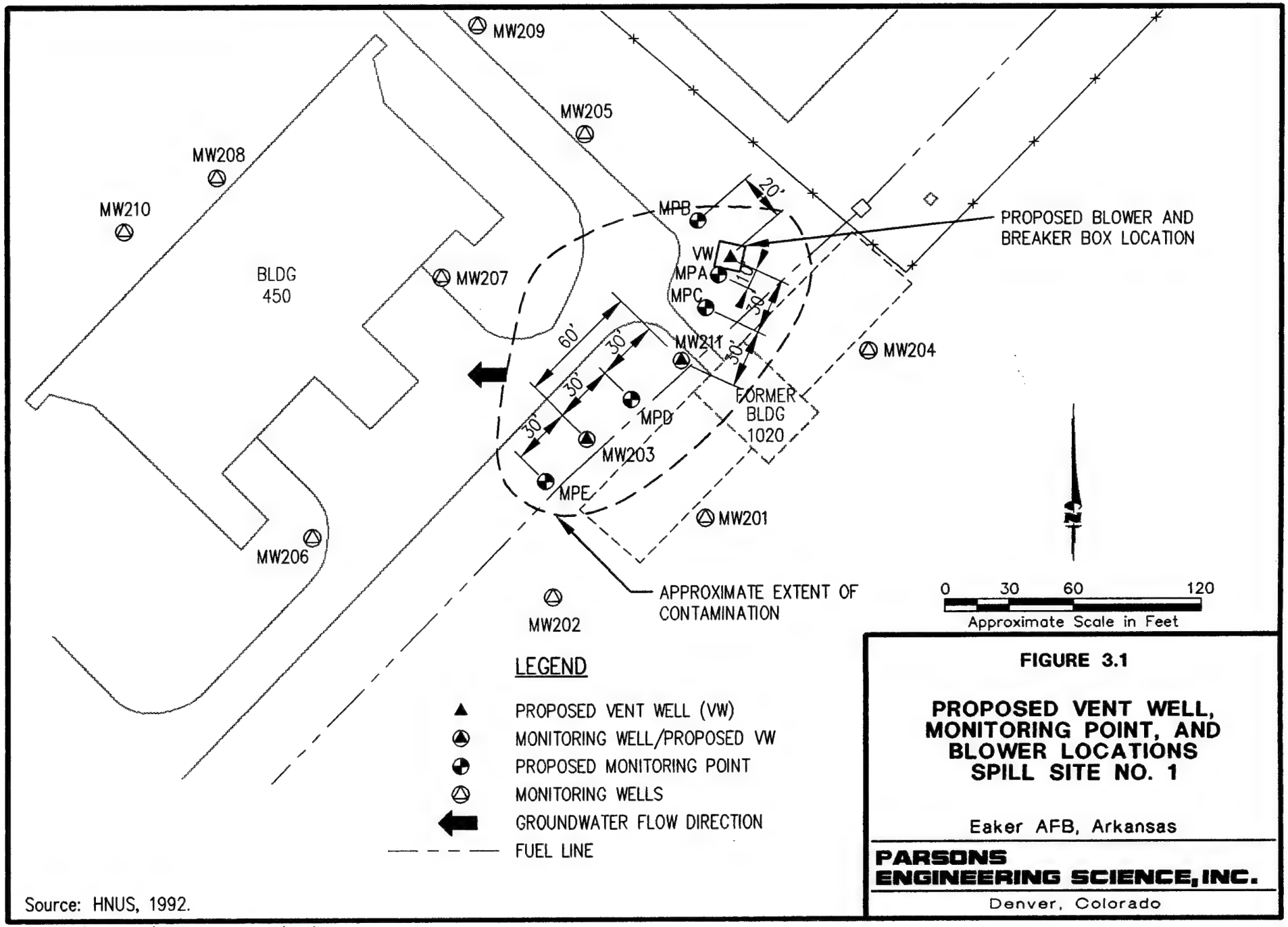

FIGURE 3.1

PROPOSED VENT WELL, MONITORING POINT, AND BLOWER LOCATIONS SPILL SITE NO. 1

Eaker AFB, Arkansas

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interval. A 2.5-foot-thick bentonite seal will be placed directly over the filter pack to produce an air-tight seal above the screened interval. The bentonite seal, consisting of granular bentonite, will be placed in 6-inch layers, with each layer hydrated in place with potable water prior to the addition of subsequent layers. A complete seal is critical to prevent injected air from short-circuiting to the surface during the bioventing test. The VW annulus will be filled with a cement/bentonite slurry to the ground surface. The blower will be placed directly over the VW, so a protective well box will not be necessary. Figure 3.2 illustrates the proposed additional VW construction detail for this site.

3.1.2 Monitoring Point Installations

A typical multi-depth vapor MP installation for this site is shown in Figure 3.3. Soil gas oxygen, carbon dioxide, and total volatile hydrocarbon (TVH) concentrations will be monitored at depths of approximately 6 feet and/or 9 feet bgs at each location. Soil temperature will be monitored using a thermocouple installed at the deep screened interval of MPA. Multi-depth monitoring will confirm that the entire soil profile is receiving oxygen, and fuel biodegradation rates can be measured at the two depths. If contamination is limited to the smear zone, only one MP interval will be installed at each location in the contaminated interval.

Each MP will be constructed with one or two vapor probes placed within a 6-9 silica sand pack, separated by bentonite seals. Each vapor probe, constructed of 6-inch-long, 0.25-inch, outside-diameter (OD) stainless steel screen implant attached to 0.5-inch-OD, high density polyethylene (HDPE) tubing that extends to the ground surface. The top of each 0.5-inch HDPE riser will be completed with a 3/8-inch needle valve. The screens will be placed within a 1-foot layer of 6-9 silica sand. The annular space between the screened MP intervals and the ground surface will be sealed with bentonite to isolate the monitoring interval. The bentonite seals will consist of granular bentonite hydrated in place. The bentonite will be placed in 6-inch layers and hydrated with potable water prior to placement of subsequent layers to ensure complete saturation of the bentonite. Additional details on VW and MP construction are presented in Section 4 of the protocol document.

3.2 Test Design for Building 457 Area

The former UST area immediately west of Building 457 is the proposed bioventing pilot test area (Figure 2.2); however, if significant vadose zone contamination (to a depth of approximately 9.5 feet bgs) is discovered in 410 Area during Geoprobe® investigative drilling and soil gas sampling, an additional VW and MPs may be installed, and the Building 457 Area blower system may be expanded to treat the 410 Area. Figure 3.4 illustrates the proposed VW location to be drilled at Building 457 Area, and proposed Geoprobe® locations to be screened for siting prospective locations for MPs or additional VWs. Review of the construction details of the existing groundwater monitoring wells (Appendix A) indicates that monitoring wells MW1201 and MW1202 are suitable for use as VWs, or as additional vapor MPs. The final location of the proposed VW to be installed near Building 457 may vary slightly from

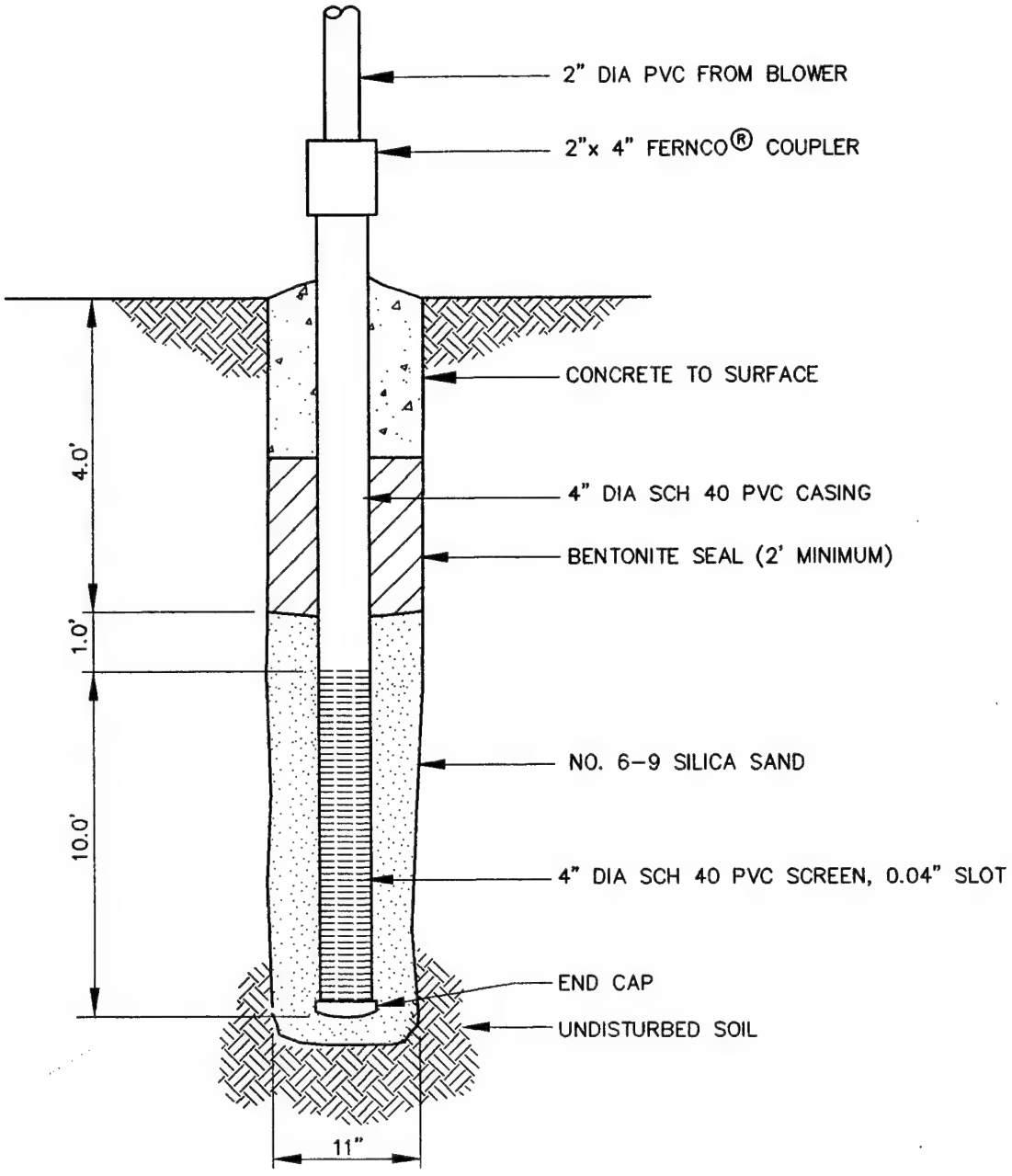

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FIGURE 3.2

PROPOSED INJECTION VENT WELL CONSTRUCTION DETAIL SPILL SITE NO. 1

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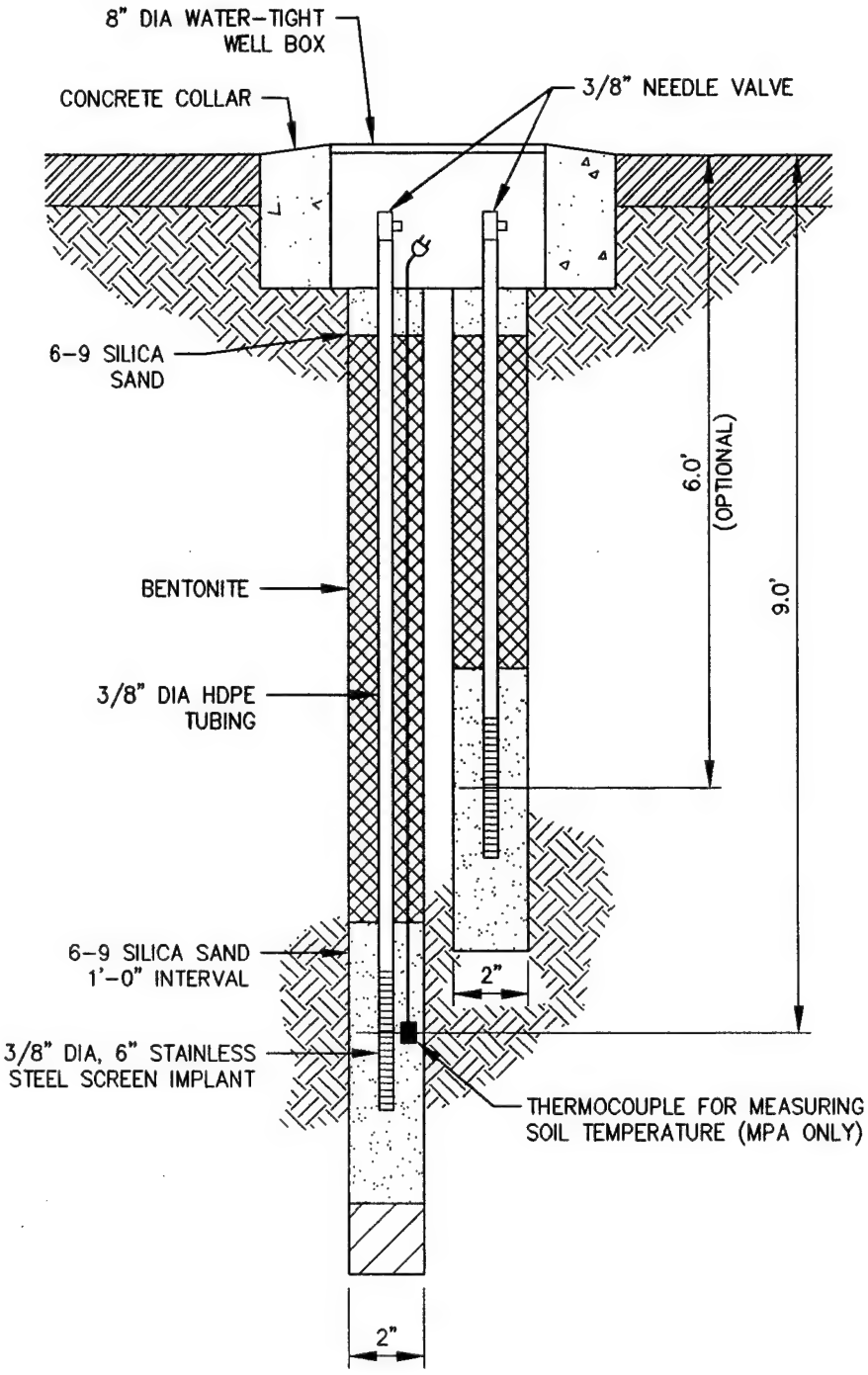

FIGURE 3.3

PROPOSED MONITORING POINT CONSTRUCTION DETAIL SPILL SITE NO. 1 (TYPICAL)

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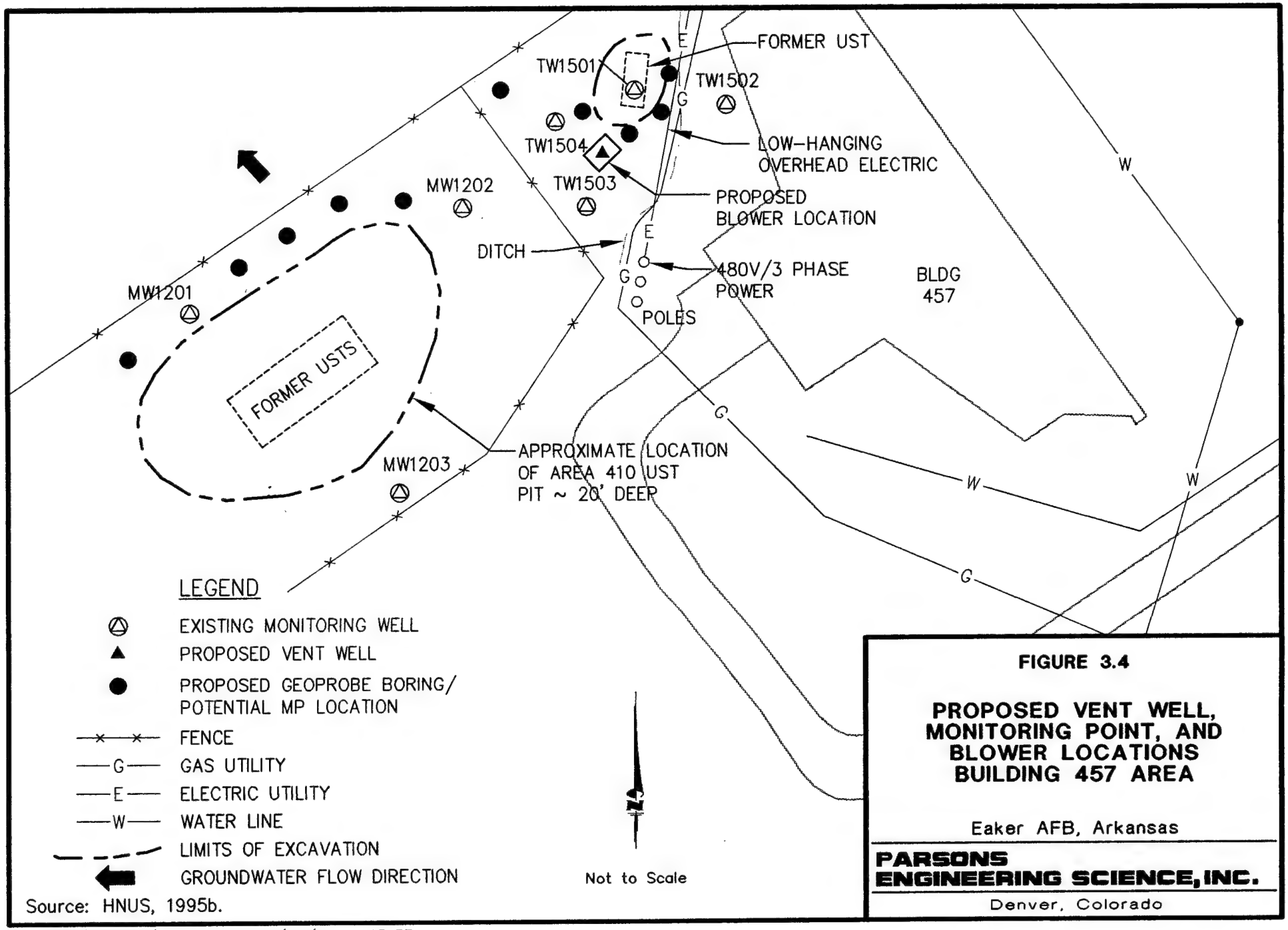

Source: HNUS, 1995b.

FIGURE 3.4

PROPOSED VENT WELL, MONITORING POINT, AND BLOWER LOCATIONS BUILDING 457 AREA

Eaker AFB, Arkansas

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Denver, Colorado

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the proposed location shown on Figure 3.4 if significant fuel contamination is not observed in the Geoprobe® borehole. If contamination is observed to extend no more than approximately 7 feet outside the former excavation, then the VW will be installed in the center of the excavation.

Because of the low-permeability soils in fuel-contaminated regions, fine-grained soils near the surface (which reduce airflow to the surface), and Parsons ES's experience with similar soil types, the potential radius of venting influence around the VW is expected to be 30 feet. Conceptually, up to two VWs and five MPs may be installed at Building 457 Area; at least two MPs will be located within a 30-foot radius of the proposed VW (Figure 3.4).

3.2.1 Vent Well Installation

The additional VW(s) will be constructed of 4-inch-diameter Schedule 40 PVC with an estimated 10-foot interval of 0.04-inch slotted screen set at 4 to 14 feet bgs. Flush-threaded PVC casing and screen with no organic solvents or glues will be used. The filter pack will be clean, well-rounded silica sand with a 6-9 grain size which will be placed in the annular space to 1 foot above the screened interval. A 3-foot-thick bentonite seal will be placed directly over the filter pack to produce an air-tight seal above the screened interval. The bentonite seal, consisting of granular bentonite, will be placed in 6-inch layers, with each layer hydrated in place with potable water prior to the addition of subsequent layers. A complete seal is critical to prevent injected air from short-circuiting to the surface during the bioventing test. A cement/bentonite slurry will be placed above the seal to the ground surface. The blower shed will be placed over the VW, so a protective well box will not be necessary. Figure 3.5 illustrates the proposed VW construction detail for this site.

3.2.2 Monitoring Point Installations

A typical multi-depth vapor MP installation for this site is shown in Figure 3.6. It is anticipated that soil gas oxygen, carbon dioxide, and TVH concentrations will be monitored only at a single depth interval of approximately 7.5 feet bgs at each location. Soil temperature will be monitored using a thermocouple installed at one of the MPs. Geoprobe® soil samples, collected in clear polybutyrate liners, will be visually inspected and screened for VOCs. A vapor probe will be placed only in those soil intervals with apparent petroleum contamination, where oxygen levels are expected to be depleted. Each MP will be constructed as described in Section 3.1.2.

3.3 Test Design for UST 702

Figure 3.7 illustrates the proposed VWs and MPs to be installed at UST 702. Review of the construction details of the existing groundwater monitoring wells (Appendix A) indicated that monitoring wells TW1601, TW1602, and TW1603 are suitable for use as VWs, or as additional vapor MPs. The final locations of the two additional proposed VWs and MPs may vary slightly from the proposed locations shown on Figure 3.7 if significant fuel contamination is not observed in the predrilled Geoprobe® borings. Soils in this area are TPH-contaminated and expected to be

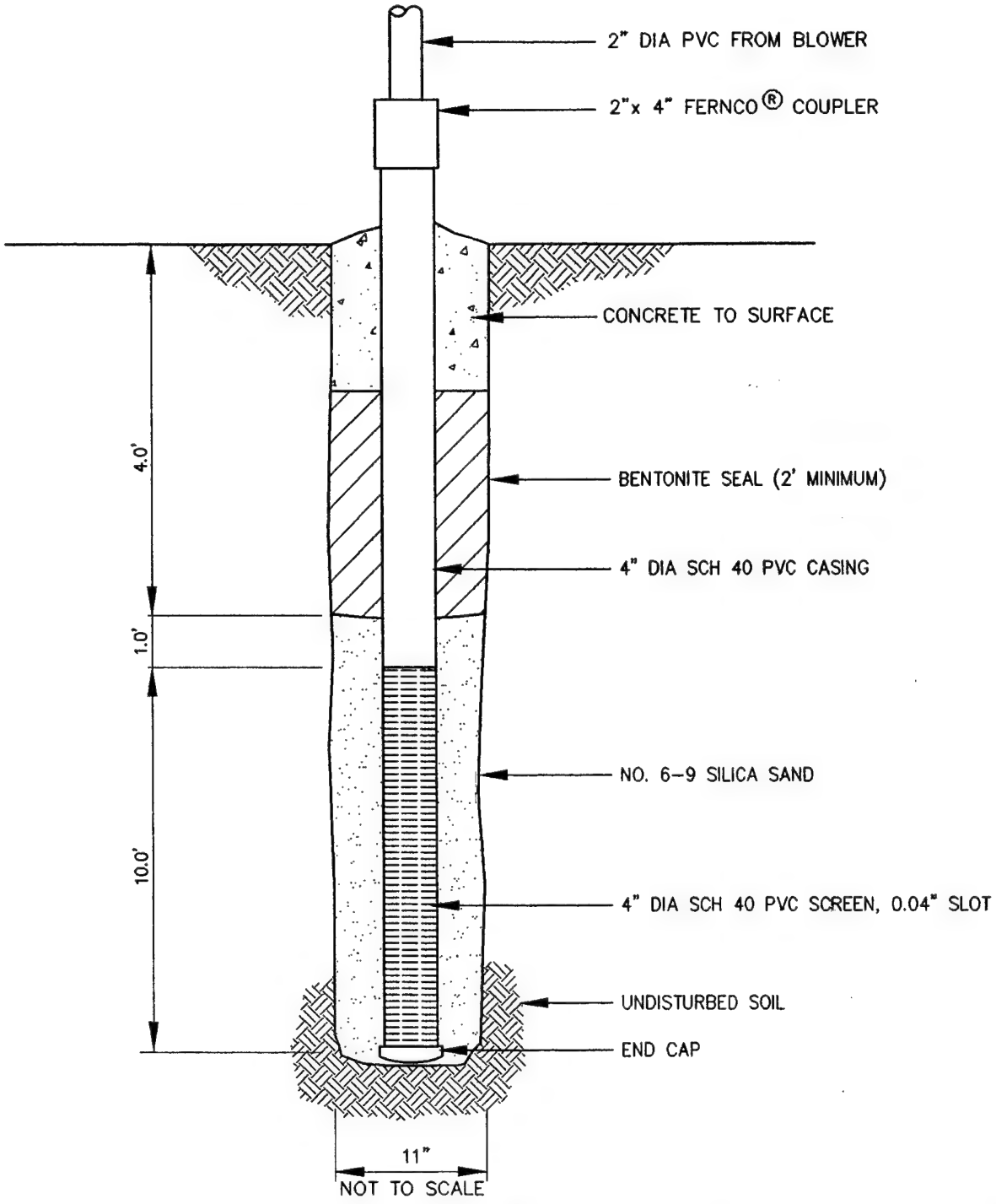

FIGURE 3.5

PROPOSED INJECTION VENT WELL CONSTRUCTION DETAIL BUILDING 457 AREA

Eaker AFB, Arkansas

PARSONS ENGINEERING SCIENCE, INC.

Denver, Colorado

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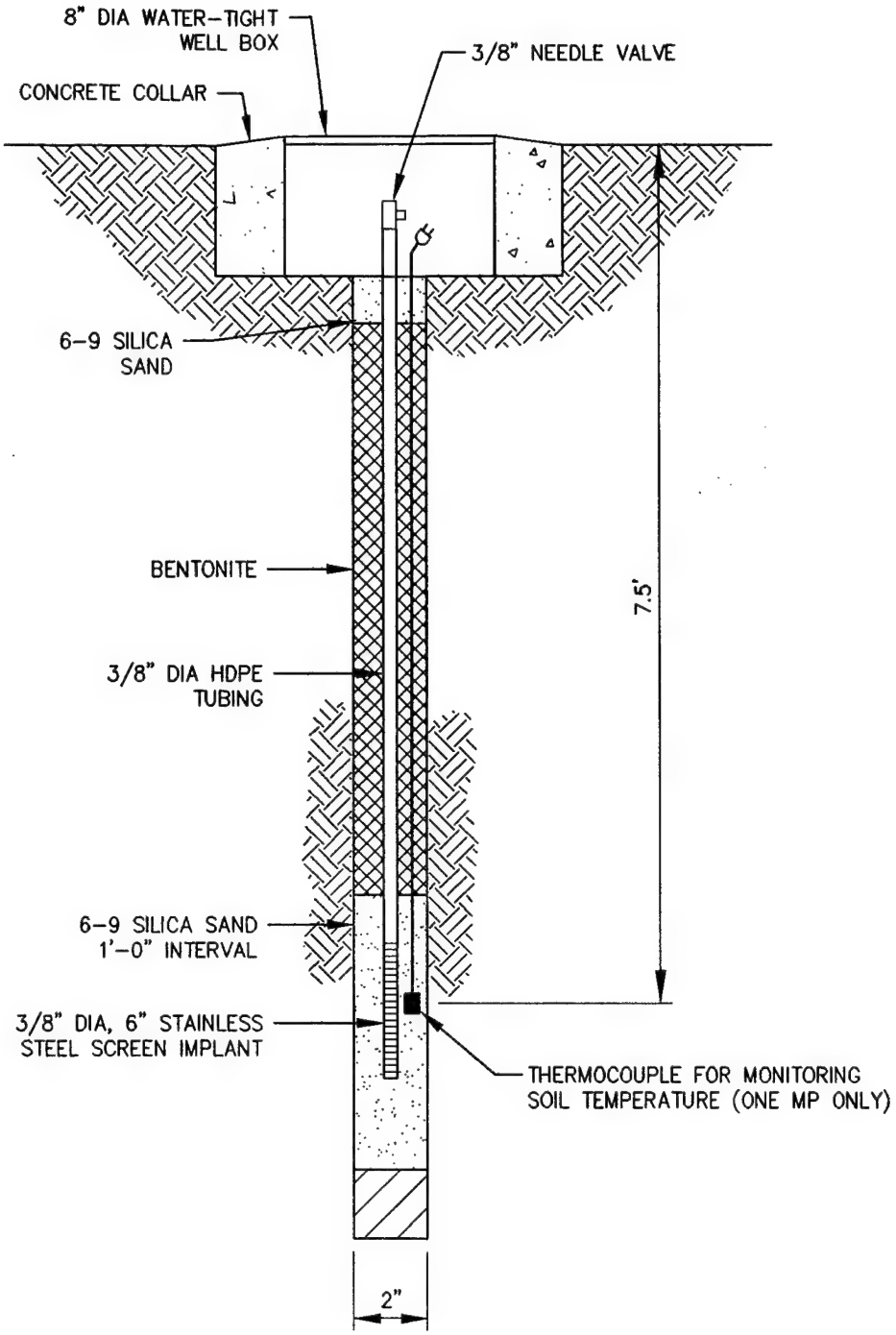

FIGURE 3.6

PROPOSED MONITORING POINT CONSTRUCTION DETAIL BUILDING 457 AREA (TYPICAL)

Eaker AFB, Arkansas

PARSONS ENGINEERING SCIENCE, INC.

Denver, Colorado

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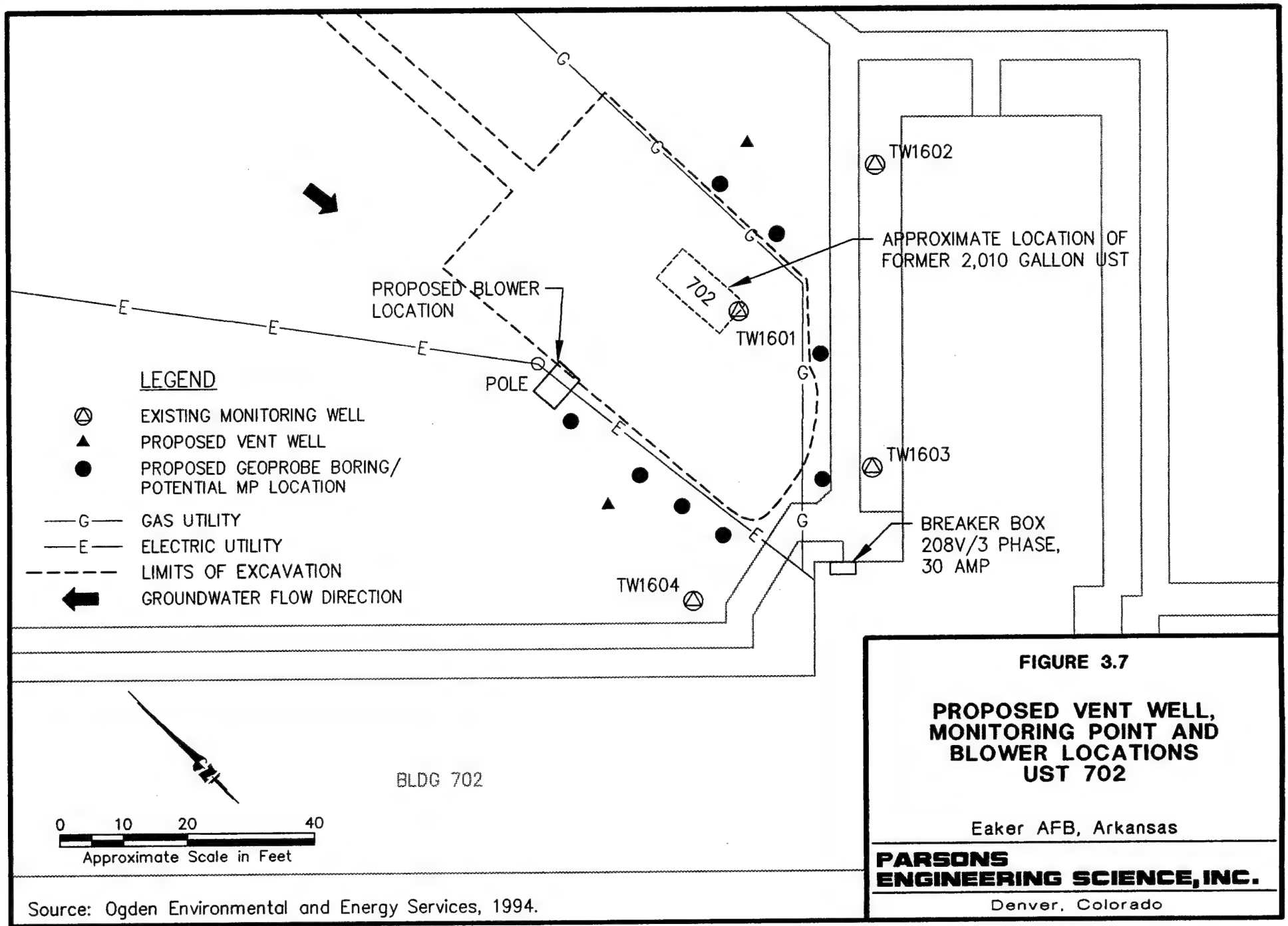

FIGURE 3.7

PROPOSED VENT WELL, MONITORING POINT AND BLOWER LOCATIONS UST 702

Eaker AFB, Arkansas

PARSONS ENGINEERING SCIENCE, INC.

Denver, Colorado

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oxygen-depleted (< 2%), and biological activity should therefore be stimulated by oxygen-rich soil gas ventilation during pilot test operations.

Because of the low-permeability soils in fuel-contaminated regions, fine-grained soils near the surface (which reduce airflow to the surface), and Parsons ES's experience with similar soil types, the potential radius of venting influence around the VWs is expected to be 30 feet. Four MPs will be located within a 30-foot radius of the VWs (Figure 3.7).

3.3.1 Vent Well Installation

The additional VW(s) will be constructed of 4-inch-diameter Schedule 40 PVC with an estimated 10-foot interval of 0.04-inch slotted screen set at 5 to 15 feet bgs. Flush-threaded PVC casing and screen with no organic solvents or glues will be used. The filter pack will be clean, well-rounded silica sand with a 6-9 grain size which will be placed in the annular space to 1 foot above the screened interval. A 2.5-foot-thick bentonite seal will be placed directly over the filter pack to produce an air-tight seal above the screened interval. The bentonite seal, consisting of granular bentonite, will be placed in 6-inch layers, with each layer hydrated in place with potable water prior to the addition of subsequent layers. A complete seal is critical to prevent injected air from short-circuiting to the surface during the bioventing test. The VW surface completion will consist of 12-inch diameter, flush-mounted, protective well box emplaced in a concrete pad. Figure 3.8 illustrates the proposed VW construction detail for this site.

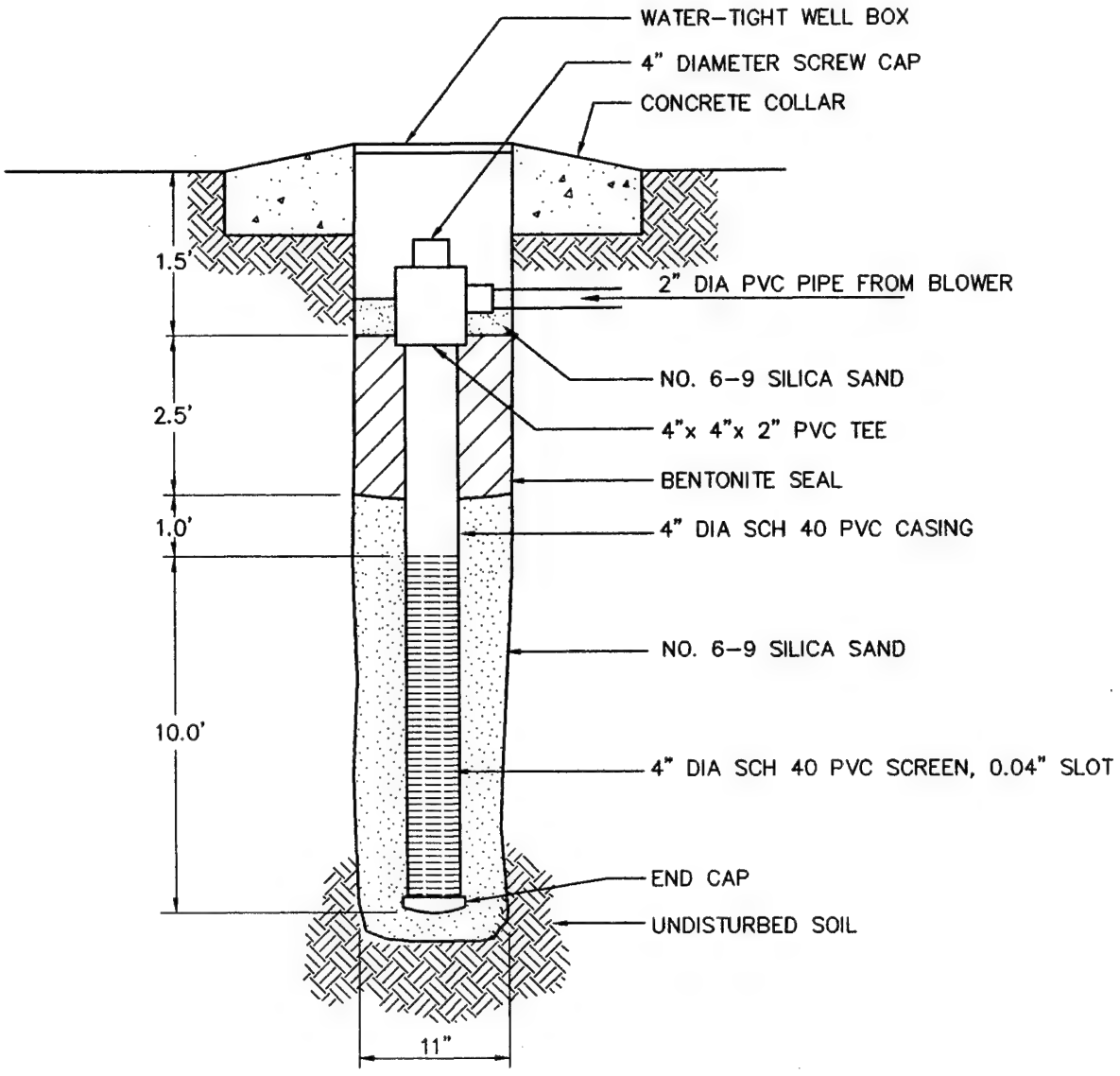
3.3.2 Monitoring Point Installations

A typical multi-depth vapor MP installation for this site is shown in Figure 3.9. It is anticipated that soil gas oxygen, carbon dioxide, and TVH concentrations will be monitored only at a single depth interval of approximately 8 feet bgs at each MP location. Soil temperature will be monitored using thermocouples installed at one of the MPs. Geoprobe® soil samples, collected in clear polybutyrate liners, will be visually inspected and screened for VOCs. A vapor probe will be placed only in those intervals with apparent petroleum contamination, where oxygen levels are expected to be depleted. Each MP will be constructed as described in Section 3.1.2.

3.4 Soil and Soil Gas Sampling

3.4.1 Soil Samples

Six soil samples will be collected from each pilot test area during installation of VWs and MPs and submitted to an analytical laboratory for analysis. Sampling procedures will follow those outlined in the protocol document. A THVA will be used during drilling to screen split-spoon samples for intervals of significant fuel contamination. Based on field screening results, six samples from the most highly contaminated locations at each site will be analyzed for total extractable petroleum hydrocarbons (TEPH) or total volatile petroleum hydrocarbons (TVPH) by EPA Method 8015 and BTEX by EPA Method 8020. Three of these samples from each site



NOT TO SCALE

FIGURE 3.8

PROPOSED INJECTION VENT WELL CONSTRUCTION DETAIL UST 702 (TYPICAL)

Eaker AFB, Arkansas

PARSONS ENGINEERING SCIENCE, INC.

Denver, Colorado

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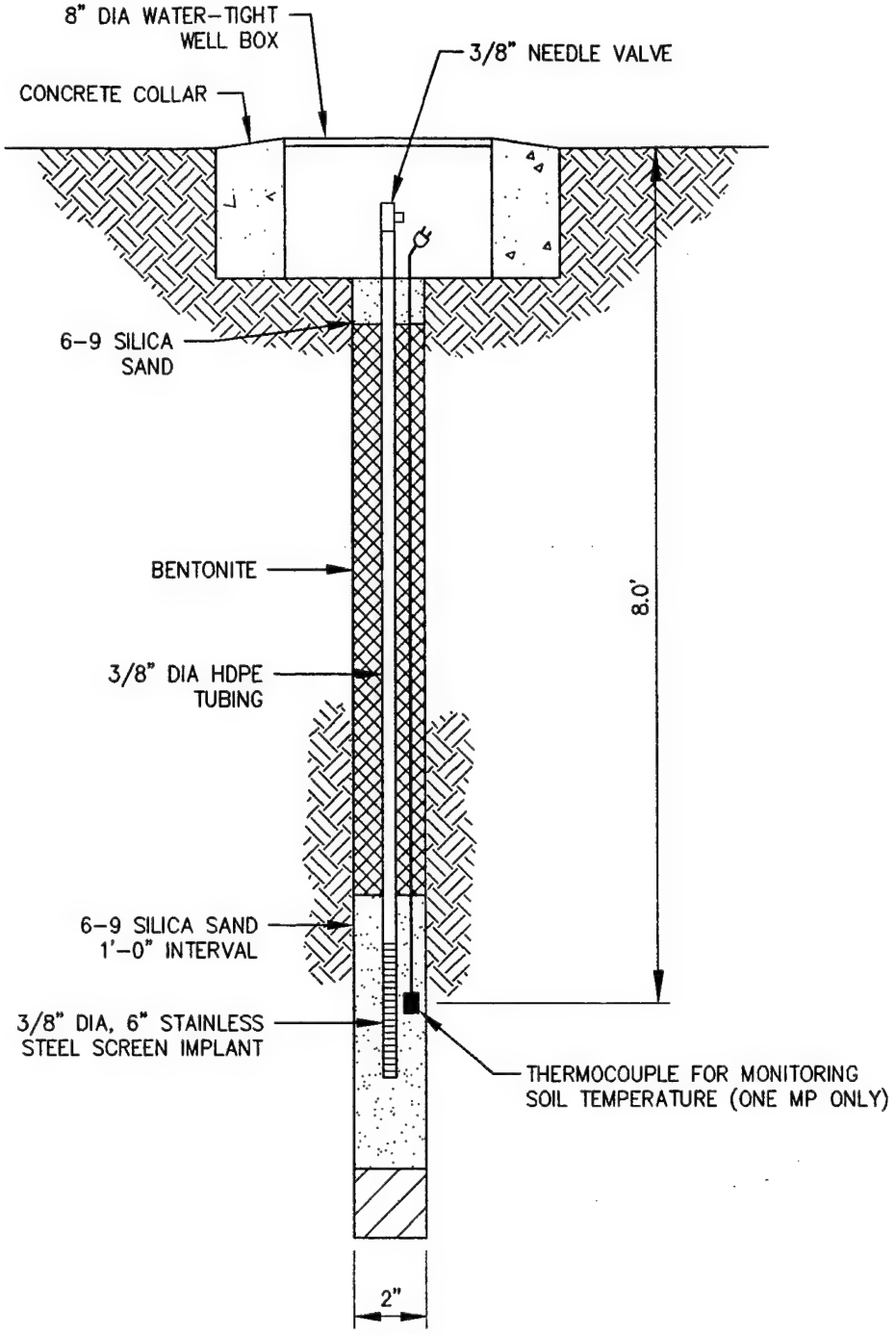

FIGURE 3.9

PROPOSED MONITORING POINT CONSTRUCTION DETAIL UST 702 (TYPICAL)

Eaker AFB, Arkansas

PARSONS ENGINEERING SCIENCE, INC.

Denver, Colorado

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also will be analyzed for soil moisture, pH, particle size, alkalinity, total iron, and nutrients. One background sample, collected from a Geoprobe® boring drilled adjacent to the selected background monitoring well, will be analyzed for total Kjeldahl nitrogen (TKN).

Samples for TEPH, TVPH, and BTEX analysis will be collected from Geoprobe® boreholes. Soil samples collected in the polybutyrate liners for TPH, BTEX, and physical parameter analyses will be immediately trimmed, and the ends will be sealed with aluminum foil or Teflon® fabric held in place by plastic caps. Soil samples will be labeled following the nomenclature specified in the protocol document (Section 5), wrapped in plastic, placed in a cooler with ice, and maintained at a temperature of approximately 4 degrees centigrade (°C) for shipment. A chain-of-custody form will be completed, and the cooler will be shipped to an AFCEE-approved laboratory for analysis.

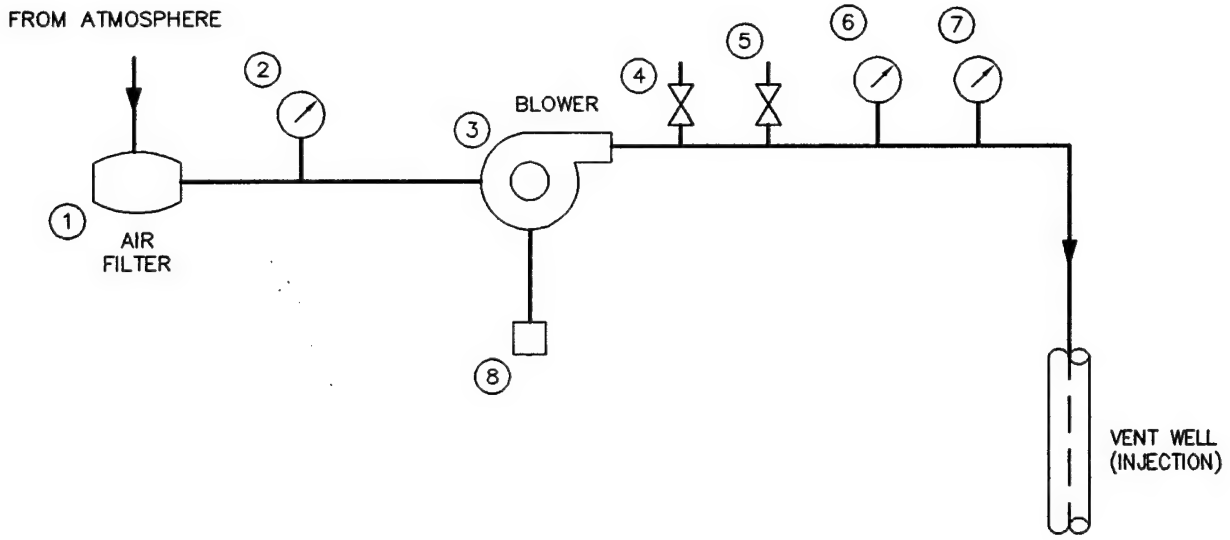
3.4.2 Soil Gas Samples

At each site, soil gas samples will be collected from nearby monitoring wells, VWs, and MPs, and field screened for oxygen, carbon dioxide, and TVH. Soil gas samples from six of the most contaminated locations at each site will be collected in SUMMA® canisters in accordance with the Bioventing Field Sampling Plan (ES, 1992) and submitted for laboratory analysis. These soil gas samples will be used to predict potential air emissions, to determine the reduction in BTEX and TVH during the 1-year test, and to detect any migration of these vapors from the source area.

Soil gas sample canisters will be placed in a small cooler and packed with foam pellets to prevent excessive movement during shipment. Samples will be sent at ambient temperature to prevent condensation of hydrocarbons. A chain-of-custody form will be completed, and the cooler will be shipped to the Air Toxics, Inc. laboratory in Folsom, California for analysis.

3.5 Blower System

A 3-horsepower positive displacement blower capable of injecting air over a wide range of flow rates and pressures will be used to conduct the initial air permeability tests at each site. Figure 3.10 presents a schematic of a typical air injection system used for pilot testing. The maximum power requirement anticipated for these pilot tests is 230-volt, three-phase, 30-amp service. Electrical power will be obtained from a nearby power pole located adjacent to each proposed blower location. An electrical distribution panel, shut-off switch, and electrical outlets will be installed on the existing pole or on the blower shed. Installation of electrical equipment and necessary wiring will be provided by an electrical subcontractor hired by Parsons ES.



LEGEND

1. INLET AIR FILTER
2. VACUUM GAUGE (IN H_2O)
3. BLOWER
4. AUTOMATIC PRESSURE RELIEF VALVE
5. MANUAL PRESSURE RELIEF (BLEED) VALVE
6. PRESSURE GAUGE – (IN H_2O)
7. TEMPERATURE GAUGE – (°F)
8. BREAKER BOX

NO SCALE

FIGURE 3.10

PROPOSED BLOWER SYSTEM INSTRUMENTATION DIAGRAM FOR AIR INJECTION (TYPICAL)

Eaker AFB, Arkansas

PARSONS ENGINEERING SCIENCE, INC.

Denver, Colorado

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3.6 *In Situ* Respiration Test

The objective of the *in situ* respiration test is to determine the rate at which soil bacteria degrade petroleum hydrocarbons. Respiration tests will be performed at selected MPs where bacterial biodegradation of hydrocarbons is indicated by low oxygen levels and elevated carbon dioxide concentrations in the soil gas. Using 1-cubic-foot-per-minute (cfm) pumps, air will be injected into approximately four MP depth intervals containing low levels (< 2 %) of oxygen at each site. Monitoring wells with low oxygen levels may also be tested. A 20-hour air injection period will be used to oxygenate local contaminated soils. At the end of the 20-hour air injection period, the air supply will be cut off, and oxygen, carbon dioxide, and TVH concentrations will be monitored during the following 48 to 72 hours. The decline in oxygen and increase in carbon dioxide concentrations over time will be used to estimate rates of bacterial degradation of fuel residuals. Helium will also be injected into the selected MP screened intervals to determine the effectiveness of the bentonite seals. Additional details on *in situ* respiration testing are found in Section 5.7 of the protocol document (Hinchee *et al.*, 1992).

3.7 Air Permeability Test

The objective of the air permeability testing is to determine the extent of the subsurface that can be oxygenated using one air injection VW. Prior to initiating the test, baseline concentrations of oxygen, carbon dioxide, and TVH will be measured in soil gas from the VW and each MP screened interval.

Air will be injected into one of the newly installed VWs at each site using a positive displacement blower unit, and pressure response will be measured at each existing monitoring well within 50 feet of the injection well and each newly installed MP with differential pressure gauges to determine the region influenced by the unit. Oxygen will also be monitored in the MPs to ascertain whether oxygen levels in the soil increase as the result of air injection. One air permeability test lasting 4 to 24 hours will be performed at each site.

Discrete vapor MPs provide a better indicator as to pressure response in different soil profiles, so testing information gathered from the monitoring wells will be used primarily to determine the radius of oxygen influence. At least two MPs (at varying distances) will be installed prior to permeability testing. Initial soil gas sampling will be performed prior to air injection.

3.8 Installation of 1-Year Pilot Test Bioventing System

Extended, 1-year pilot-scale bioventing systems will also be installed at Spill Site No. 1, Building 457 Area, and UST 702. The systems will be designed based upon the results of the initial respiration and permeability tests. However, it is anticipated that the extended test blowers will have flow rates in the range of 25 to 50 scfm and will not exceed 4 horsepower. The blowers will each be housed in a small, lockable,

prefabricated shed to provide protection from the weather. At each site, a licensed electrical subcontractor to Parsons ES will provide a 208-volt, three-phase, 30-amp service. The blower units will be explosion-proof, and electrical wiring will be installed in accordance with the National Electric Code (NEC) and Base codes for locations with potentially explosive atmospheres.

The systems will be in operation for 1 year. Bimonthly system checks will be performed by Eaker AFB personnel. If required, major maintenance of the blower units will be performed by Parsons ES personnel. Detailed blower system information and a maintenance schedule will be included in the operation and maintenance (O&M) manual that will be provided to the AFBCA. After the systems have operated for 1 year, Parsons ES personnel will return to the sites to conduct *in situ* respiration testing and soil gas sampling to determine the long-term effectiveness of the systems.

4.0 HANDLING OF INVESTIGATION-DERIVED WASTE

All soil cuttings will be hauled to a nearby Base soil landfarm designated by the Base. Few cuttings will be generated from the VW boreholes; only about 4 cubic yards. Drill cuttings will be disposed of in accordance with the current procedures for ongoing remedial investigations at Eaker AFB.

5.0 EXCEPTIONS TO PROTOCOL PROCEDURES

The procedures that will be used to measure the air permeability of the soil and *in situ* respiration rates are described in Sections 4 and 5, respectively, of the protocol document. No exceptions to the protocol are anticipated.

6.0 BASE SUPPORT REQUIREMENTS

The following Base support is needed prior to the arrival of the drilling subcontractor and the Parsons ES pilot test team:

- Assistance in obtaining drilling and digging permits.

During initial testing, the following Base support is needed:

- Twelve square feet of desk space and a telephone in a building located as close to the site as practical.
- The use of a facsimile machine for transmitting 15 to 20 pages of test results.
- A decontamination area where the driller can clean augers between borings.
- A potable water supply for well construction and decontamination activities.

During the 1-year extended pilot test, Base or AFBCA personnel will be required to perform the following activities:

- Check the blower system once per every two weeks to ensure that it is operating, and to record the air injection pressure and other parameters. Parsons ES personnel will provide a brief training session on this procedure.

- If the blower stops working, notify Mr. Dave Teets or Mr. John Ratz of Parsons ES at (303) 831-8100; or Lt Maryann Jenner of AFCEE at (210) 536-5688, or Mr. Jerry Hansen of AFCEE at (210) 536-4353.

7.0 PROJECT SCHEDULE

The following schedule is contingent upon approval of this pilot test work plan and completion of base support requirements.

Event	Date
Draft Test Work Plan to AFCEE/Eaker AFB	9 February 1996
Field Mobilization	16 March 1996
Preconstruction Meeting	18 March 1996 (10AM)
Begin Initial Pilot Tests	18 March 1996
Postconstruction Meeting	4 April 1996 (10AM)
Demobilization	5 April 1996
Letter Results Report	17 May 1996
Final Respiration Test and Soil Gas Sampling	March 1997

8.0 POINTS OF CONTACT

Mr. Thomas Zachary
AFBCA/OL-J
P.O. Box 9400
Gosnell, AR 72319-0400
COM (501) 532-6550
FAX (501) 532-8738

Mr. David Teets and Mr. John Ratz
Parsons Engineering Science, Inc.
1700 Broadway, Suite 900
Denver, CO 80290
(303) 831-8100
Fax (303) 831-8208

Lt Maryann Jenner or Jerry Hansen
AFCEE/ERT
8001 Arnold Drive
Brooks AFB, TX 78235-5000
(210) 536-5688, (210) 536-4353
Fax (210) 536-4330

9.0 REFERENCES

Engineering-Science, Inc. 1992. *Field Sampling Plan for AFCEE Bioventing*. January.

Haliburton NUS Environmental Corporation (HNUS), 1992. Technical Memorandum (Step 2) for the Remdial Investigation/Feasibility Study.

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HNUS, 1995b. Information received via fax on December 8.

Hinchee, R.E., S.K. Ong, R.N. Miller, D.C. Downey, and R. Frendt. 1992. *Test Plan and Technical Protocol for a Field Treatability Test for Bioventing*. May.

Looney, Randal J. 1996. Personal communication. Phone conversation between Randal J. Looney (Eaker AFBCA) and David B. Teets (Parsons ES) regarding site history of 410 Area, February 1, 1996.

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US Air Force, 1994. Statement of Work, Title 1 A-E Services for Bioventing Monitoring/Full-Scale Design. Contract No. F41624-92-D-8036, Delivery Order 17. May 26

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APPENDIX A

MONITORING WELL AS-BUILT CONSTRUCTION DIAGRAMS

Halliburton NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: EAKER AFB

JOB NUMBER: 0114 | PROJECT MANAGER: A. JENKINS

LOGGED BY: B. McCANLESS | EDITED BY:

WELL NAME: TW1601 | DATE: 9/12/95

DRILLING COMPANY: TRI-STATE

EQUIPMENT: ☑ 7¼ INCH HOLLOW STEM AUGER ☐ ____ INCH ROTARY WASH | DRILLER: J. FLEEGER | HOURS DRILLED: 0.75

GALLONS OF WATER USED DURING DRILLING: 10 13 GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: STEAM CLEAN

DEVELOPMENT

METHOD OF DEVELOPMENT: SEE DEVELOPMENT FORM

DEVELOPMENT BEGAN DATE: TIME:

YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

4 1/3 SACKS OF MORIE CO. FILTRATION OUN SAND

____ SACKS OF ____ CEMENT

____ GALLONS OF GROUT USED

____ SACKS OF POWDERED BENTONITE

62.5 POUNDS OF BENTONITE PELLETS 1¼ BUCKETS

10 FEET OF 2 INCH PVC BLANK CASING

10 FEET OF 2 INCH PVC SLOTTED SCREEN

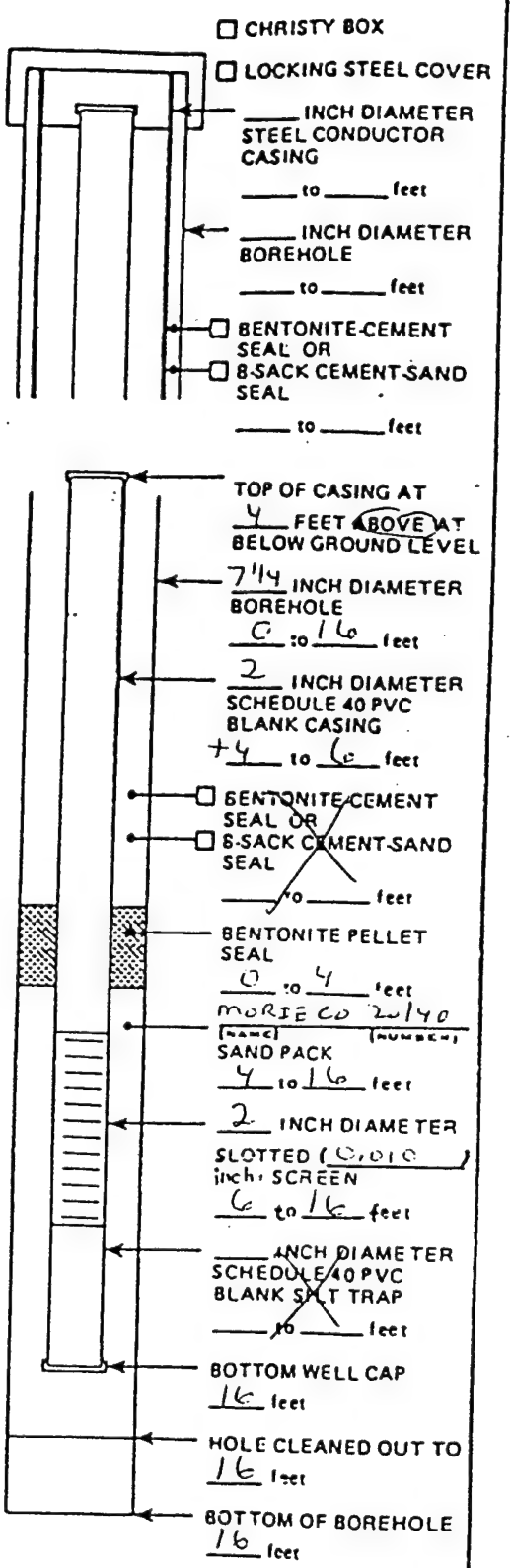
____ YARD³ CEMENT-SAND (REDI-MIX) ORDERED

____ YARD³ CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☑ NO ☐ YES

NAME ____

WELL COVER USED: ☐ LOCKING STEEL COVER ☐ CHRISTY BOX ☑ OTHER TEMP WELL



NOT TO SCALE

ADDITIONAL INFORMATION: ____

SAND CALC: 6 BAGS

Halliburton NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: EAKER AFB

JOB NUMBER: 0114 | PROJECT MANAGER: A. JENKINS

LOGGED BY: B. McCANLESS | EDITED BY:

WELL NAME: TW1602 | DATE: 9/12/95

DRILLING COMPANY: TRI STATE

EQUIPMENT: ☒ 7 1/4 INCH HOLLOW STEM AUGER | DRILLER: J. FLEEGER

☐ _____ INCH ROTARY WASH | HOURS DRILLED: 0.5'

GALLONS OF WATER USED DURING DRILLING: _____ GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: STEAM CLEAN

DEVELOPMENT

METHOD OF DEVELOPMENT: DEVELOPMENT FORM

DEVELOPMENT BEGAN DATE: _____ TIME: _____

YIELD: _____ GPM	TIME: FROM _____ TO _____	DATE:	
YIELD: _____ GPM	TIME: FROM _____ TO _____	DATE:	
YIELD: _____ GPM	TIME: FROM _____ TO _____	DATE:	
YIELD: _____ GPM	TIME: FROM _____ TO _____	DATE:	

TOTAL WATER REMOVED DURING DEVELOPMENT: _____ GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER: _____

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER _____

DEPTH TO WATER AFTER DEVELOPMENT: _____ FEET

MATERIALS USED

3.5 4 SACKS OF MORIE CO. FILTRATION CON SAND

_____ SACKS OF _____ CEMENT

_____ GALLONS OF GROUT USED

_____ SACKS OF POWDERED BENTONITE

87.5 POUNDS OF BENTONITE PELLETS 1 3/4 BUCKET

10 FEET OF 2 INCH PVC BLANK CASING

10 FEET OF 2 INCH PVC SLOTTED SCREEN

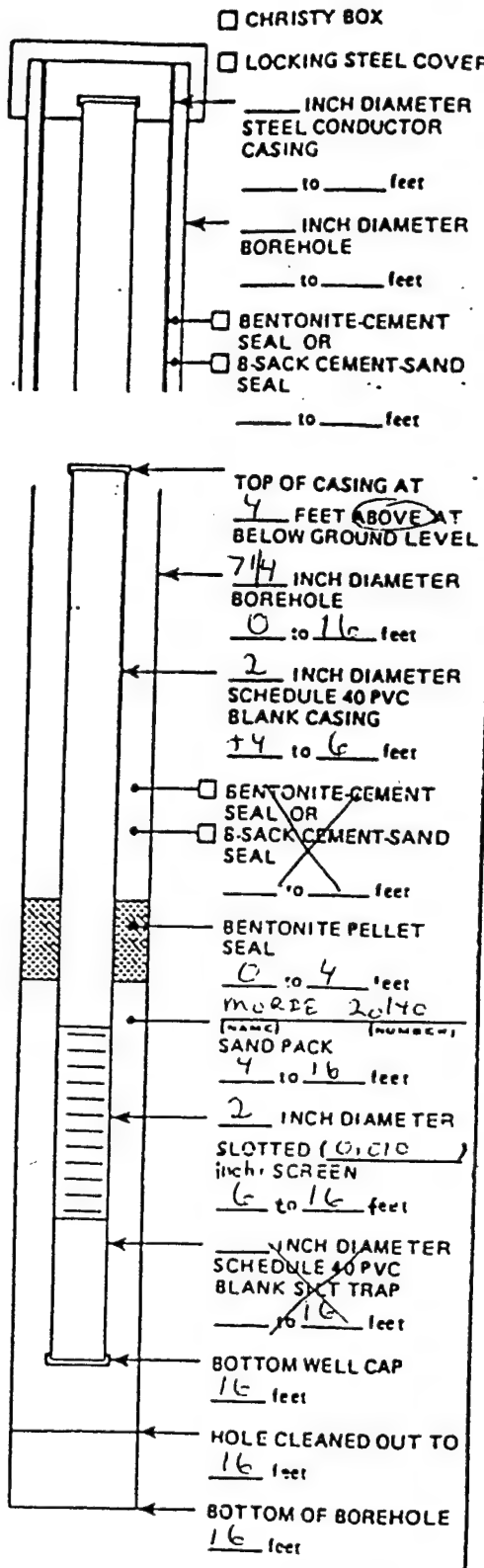
_____ YARD^3 CEMENT-SAND (REDI-MIX) ORDERED

_____ YARD^3 CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☒ NO ☐ YES

NAME _____

WELL COVER USED: ☐ LOCKING STEEL COVER ☐ CHRISTY BOX ☒ OTHER TEMP. WELL



NOT TO SCALE

ADDITIONAL INFORMATION: SAND CALC.= 6 BAGS

Halliburton NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: EAKER AFB

JOB NUMBER: 0114 | PROJECT MANAGER: A. JENKINS

LOGGED BY: B. McCANLESS | EDITED BY:

WELL NAME: TW1603 | DATE: 9/12/95

DRILLING COMPANY: TRI-STATE

EQUIPMENT: ☒ 7¼ INCH HOLLOW STEM AUGER ☐ ____ INCH ROTARY WASH | DRILLER: J. FLEEGER | HOURS DRILLED: 0.50

GALLONS OF WATER USED DURING DRILLING: 5 GALLONS TO HYDRATE PELLETS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: STEAM CLEAN

DEVELOPMENT

METHOD OF DEVELOPMENT: DEVELOPMENT FORM

DEVELOPMENT BEGAN DATE: TIME:

YIELD:	TIME: FROM	TO	DATE:
____ GPM			
____ GPM			
____ GPM			
____ GPM			

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

4 SACKS OF MORIE CO. FILTRATION SAND

____ SACKS OF ____ CEMENT

____ GALLONS OF GROUT USED

____ SACKS OF POWDERED BENTONITE

75 POUNDS OF BENTONITE PELLETS 1.5 BUCKETS

10 FEET OF 2 INCH PVC BLANK CASING

10 FEET OF 2 INCH PVC SLOTTED SCREEN

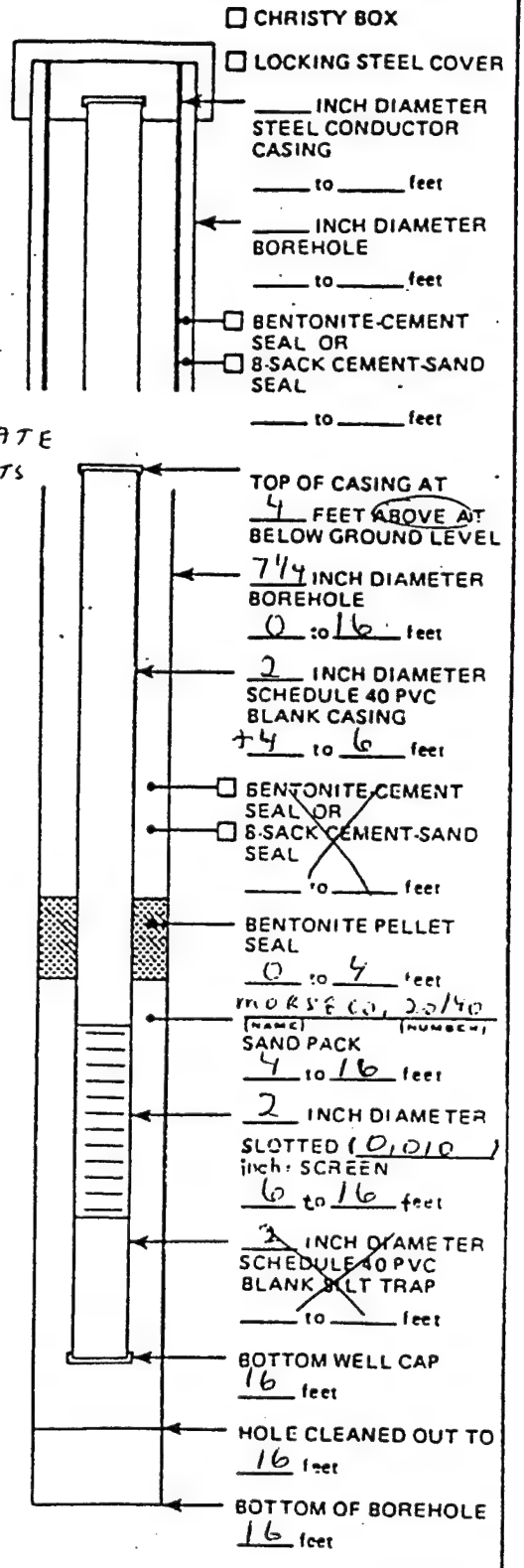
____ YARD³ CEMENT-SAND (REDI-MIX) ORDERED

____ YARD³ CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☒ NO ☐ YES

NAME ____

WELL COVER USED: ☐ LOCKING STEEL COVER ☐ CHRISTY BOX ☒ OTHER TEMP. WELL



NOT TO SCALE

ADDITIONAL INFORMATION: SAND CALC = 6 BAGS

Halliburton NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: EAKER AFB A JENKINS
JOB NUMBER: 0114
PROJECT MANAGER: JOE FLEEGER
LOGGED BY: B. McCANLESS
EDITED BY:
WELL NAME: TW1604
DATE: 9/12/95
DRILLING COMPANY: TRI-STATE
EQUIPMENT: ☑ 7¼ INCH HOLLOW STEM AUGER ☐ ____ INCH ROTARY WASH
DRILLER: J. FLEEGER
HOURS DRILLED: 0.5
GALLONS OF WATER USED DURING DRILLING: 20 GALLONS 15 GALS TO SURGE 5 GALS TO HYDRATE
METHOD OF DECONTAMINATION PRIOR TO DRILLING: STEAM CLEAN

DEVELOPMENT

METHOD OF DEVELOPMENT: DEVELOPMENT PUMP
DEVELOPMENT BEGAN DATE: TIME:

YIELD: ____ GPM	TIME: FROM ____ TO ____	DATE:
YIELD: ____ GPM	TIME: FROM ____ TO ____	DATE:
YIELD: ____ GPM	TIME: FROM ____ TO ____	DATE:
YIELD: ____ GPM	TIME: FROM ____ TO ____	DATE:

TOTAL WATER REMOVED DURING DEVELOPMENT: ____ GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

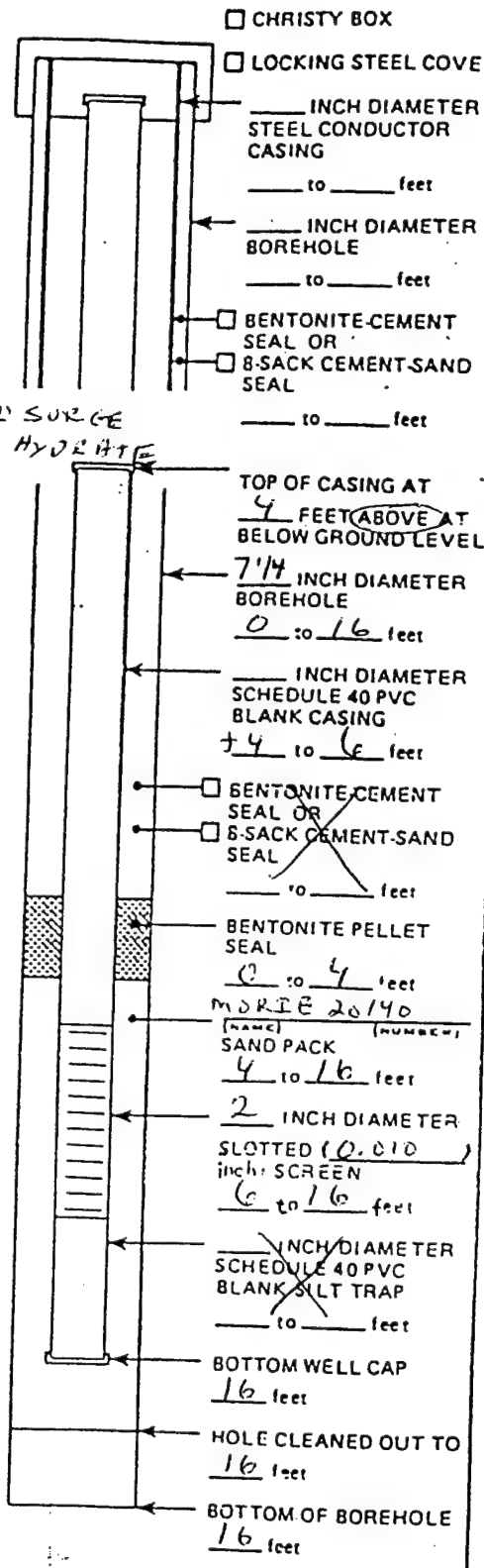
WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

DEPTH TO WATER AFTER DEVELOPMENT: ____ FEET

MATERIALS USED

4.5 SACKS OF MORIE CO. FILTRATION 20/40 SAND
____ SACKS OF ____ CEMENT
____ GALLONS OF GROUT USED
____ SACKS OF POWDERED BENTONITE
50 POUNDS OF BENTONITE PELLETS 1 BUCKET
10 FEET OF 2 INCH PVC BLANK CASING
10 FEET OF 2 INCH PVC SLOTTED SCREEN

____ YARD³ CEMENT-SAND (REDI-MIX) ORDERED
____ YARD³ CEMENT-SAND (REDI-MIX) USED
CONCRETE PUMPER USED? ☑ NO ☐ YES
NAME ____
WELL COVER USED: ☐ LOCKING STEEL COVER ☐ CHRISTY BOX ☑ OTHER TEMP WELL



NOT TO SCALE

ADDITIONAL INFORMATION: SAND CALC = 6 BAGS

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: BAFB JP-1 site

JOB NUMBER: 1599 PROJECT MANAGER: J Nelson

LOGGED BY: D. Henriksen EDITED BY: J. Lewis

WELL NAME: MW-201 DATE: 2/28

DRILLING COMPANY: A.W. Peal

EQUIPMENT: ☒ 7¼ INCH HOLLOW STEM AUGER ☐ ____ INCH ROTARY WASH

DRILLER: G. Peal

HOURS DRILLED:

GALLONS OF WATER USED DURING DRILLING: 0 GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: pressure steam clean

DEVELOPMENT

METHOD OF DEVELOPMENT: bailing

DEVELOPMENT BEGAN DATE: TIME:

YIELD:	TIME: FROM	TO	DATE:
____ GPM			
____ GPM			
____ GPM			
____ GPM			

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

3 SACKS OF 12-28 SAND

____ SACKS OF Port. Type II CEMENT

____ GALLONS OF GROUT USED

____ SACKS OF POWDERED BENTONITE

25 POUNDS OF BENTONITE PELLETS

10 ft FEET OF 2 INCH PVC BLANK CASING

15 FEET OF 2 INCH PVC SLOTTED SCREEN

1 - 0.1' screw on bott. cap

25.1
- 3.6
22.1

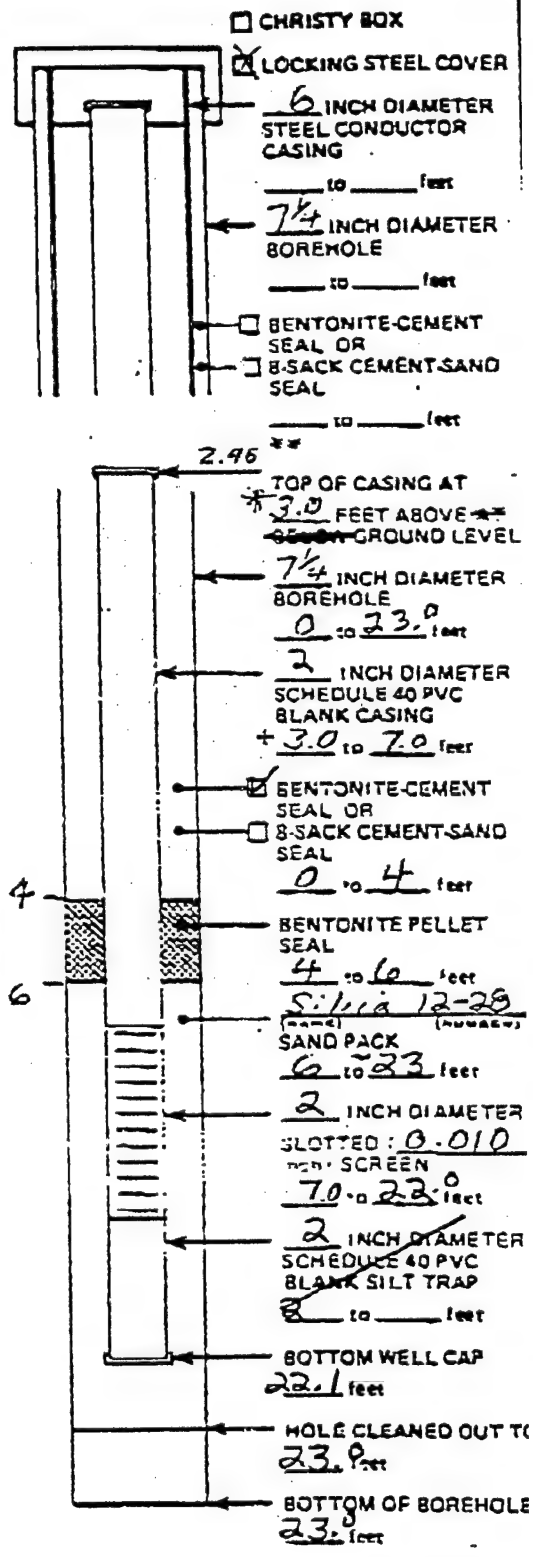
____ YARD³ CEMENT-SAND (REDI-MIX) ORDERED

____ YARD³ CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☒ NO ☐ YES

NAME ____

WELL COVER USED: ☒ LOCKING STEEL COVER ☐ CHRISTY BOX ☐ OTHER



NOT TO SCALE

ADDITIONAL INFORMATION: riser + screen steam cleaned

* prior to cut-off

** -

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: BAFB JP-1 site

JOB NUMBER: LS99 | PROJECT MANAGER: J. Nielsen

LOGGED BY: A. Jenkins | EDITED BY: J. Lewis

WELL NAME: MW-202 | DATE: 4/28

DRILLING COMPANY: A.W. Pool

EQUIPMENT: ☑ 7¼ INCH HOLLOW STEM AUGER | DRILLER: E. Pool

☐ ____ INCH ROTARY WASH | HOURS DRILLED:

GALLONS OF WATER USED DURING DRILLING: 0 GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: pressure steam cleaning

DEVELOPMENT

METHOD OF DEVELOPMENT: bailing

DEVELOPMENT BEGAN DATE: TIME:

YIELD: ____ GPM	TIME: FROM	TO	DATE:
YIELD: ____ GPM	TIME: FROM	TO	DATE:
YIELD: ____ GPM	TIME: FROM	TO	DATE:
YIELD: ____ GPM	TIME: FROM	TO	DATE:

TOTAL WATER REMOVED DURING DEVELOPMENT: ____ GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

DEPTH TO WATER AFTER DEVELOPMENT: ____ FEET

MATERIALS USED

3 SACKS OF 12-28 SAND

____ SACKS OF Port. Type II CEMENT

____ GALLONS OF GROUT USED

____ SACKS OF POWDERED BENTONITE

25 POUNDS OF BENTONITE PELLETS

10 FEET OF 2 INCH PVC BLANK CASING

15 FEET OF 2 INCH PVC SLOTTED SCREEN

1 - 0.1' screw on bott. cap

____ YARD³ CEMENT-SAND (REDI-MIX) ORDERED

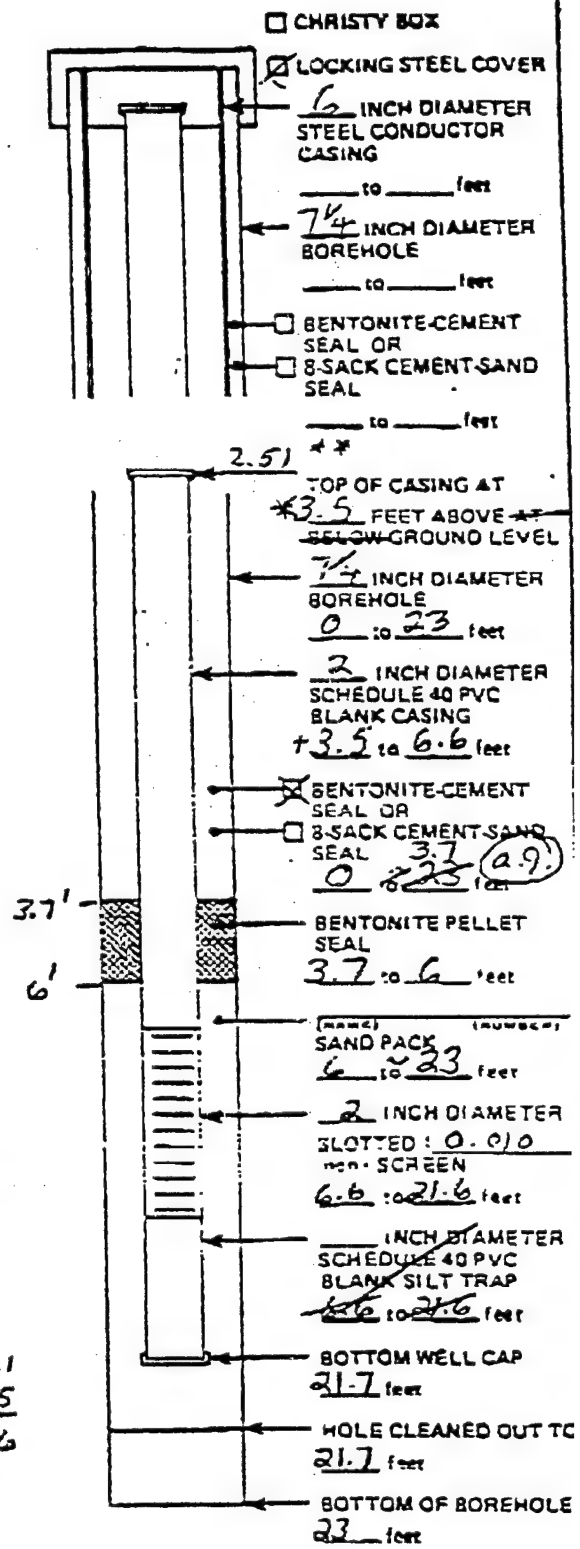
____ YARD³ CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☒ NO ☐ YES

NAME ____

WELL COVER USED: ☑ LOCKING STEEL COVER ☐ CHRISTY BOX ☐ OTHER

25.1
-3.5
21.6



NOT TO SCALE

ADDITIONAL INFORMATION: riser + screen steam cleaned

* prior to cut-off

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: BAFB Site JP-1

JOB NUMBER: L599 | PROJECT MANAGER: J. Nelson

LOGGED BY: A. Jenkins | EDITED BY: J. Lewis

WELL NAME: MW 203 | DATE: 4/29/93

DRILLING COMPANY: A.W. Pool

EQUIPMENT: ☒ 7¼ INCH HOLLOW STEM AUGER | DRILLER: G. Pool

☐ _____ INCH ROTARY WASH | HOURS DRILLED:

GALLONS OF WATER USED DURING DRILLING: ○ GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: pressure steam

DEVELOPMENT

METHOD OF DEVELOPMENT: bailing

DEVELOPMENT BEGAN DATE: TIME:

YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER _____

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

5 SACKS OF 12-28 SAND

_____ SACKS OF Port. Type II CEMENT

_____ GALLONS OF GROUT USED

_____ SACKS OF POWDERED BENTONITE

25 POUNDS OF BENTONITE PELLETS

10 FEET OF 2 INCH PVC BLANK CASING

15 FEET OF 2 INCH PVC SLOTTED SCREEN

1-0.1' spacer on bott. cap

25.1
-4
21.1

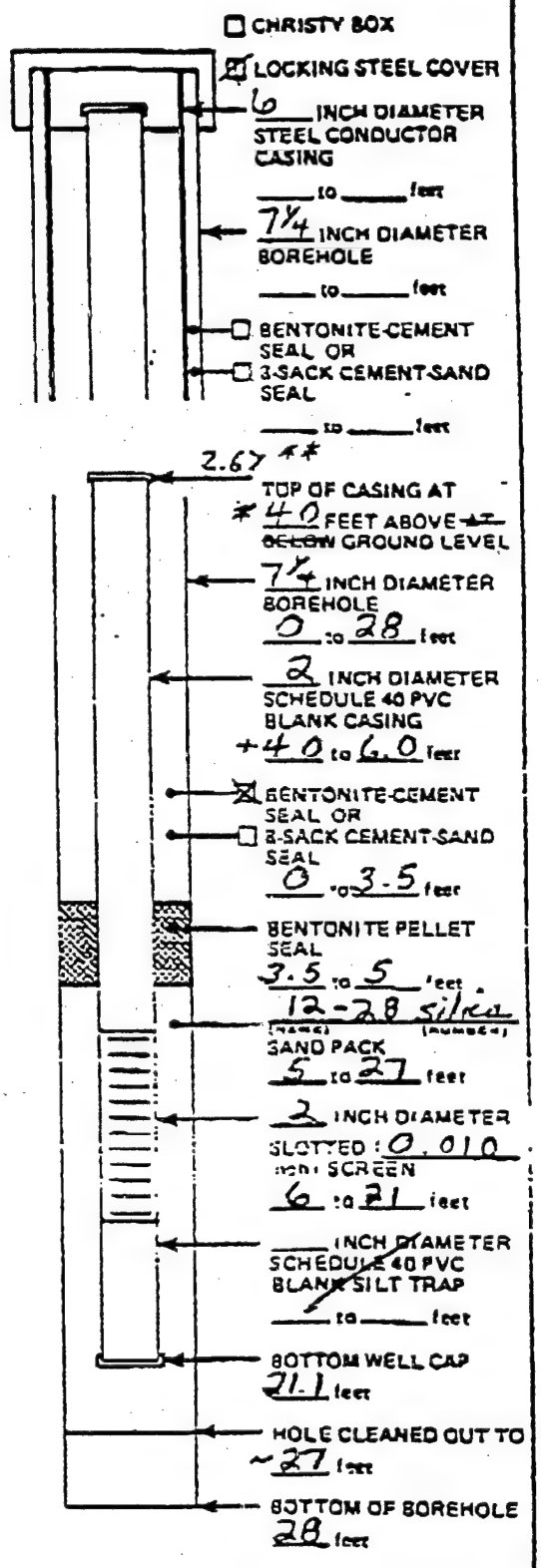
_____ YARD³ CEMENT-SAND (READI-MIX) ORDERED

_____ YARD³ CEMENT-SAND (READI-MIX) USED

CONCRETE PUMPER USED? ☒ NO ☐ YES

NAME _____

WELL COVER USED: ☒ LOCKING STEEL COVER ☐ CHRISTY BOX



NOT TO SCALE

ADDITIONAL INFORMATION:

* prior to cut-off

** After 1.33' cut off and survey completed.

Halliburton NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Eaker AFB

JOB NUMBER: 0114 | PROJECT MANAGER: AJ

LOGGED BY: BDH | EDITED BY:

WELL NAME: MW205 | DATE: 4/9/95

DRILLING COMPANY: Tri-State Testing

EQUIPMENT: ☒ 7¼ INCH HOLLOW STEM AUGER ☐ ____ INCH ROTARY WASH | DRILLER: Joe Flagg | HOURS DRILLED:

GALLONS OF WATER USED DURING DRILLING: NA GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Clean

DEVELOPMENT

METHOD OF DEVELOPMENT: SEE WELL DEVELOPMENT FORM

DEVELOPMENT BEGAN DATE: TIME:

YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

10.5 SACKS OF ~~Lapis~~ 20/40 silica bag MW sand

____ SACKS OF ____ CEMENT

____ GALLONS OF GROUT USED

____ SACKS OF POWDERED BENTONITE

75 POUNDS OF BENTONITE PELLETS

11.7 ~~10.0~~ FEET OF 2 INCH PVC BLANK CASING

~~20.0~~ 10.0 FEET OF 2 INCH ~~PVC~~ SLOTTED SCREEN

2.0 feet of 2 inch SS silt trap

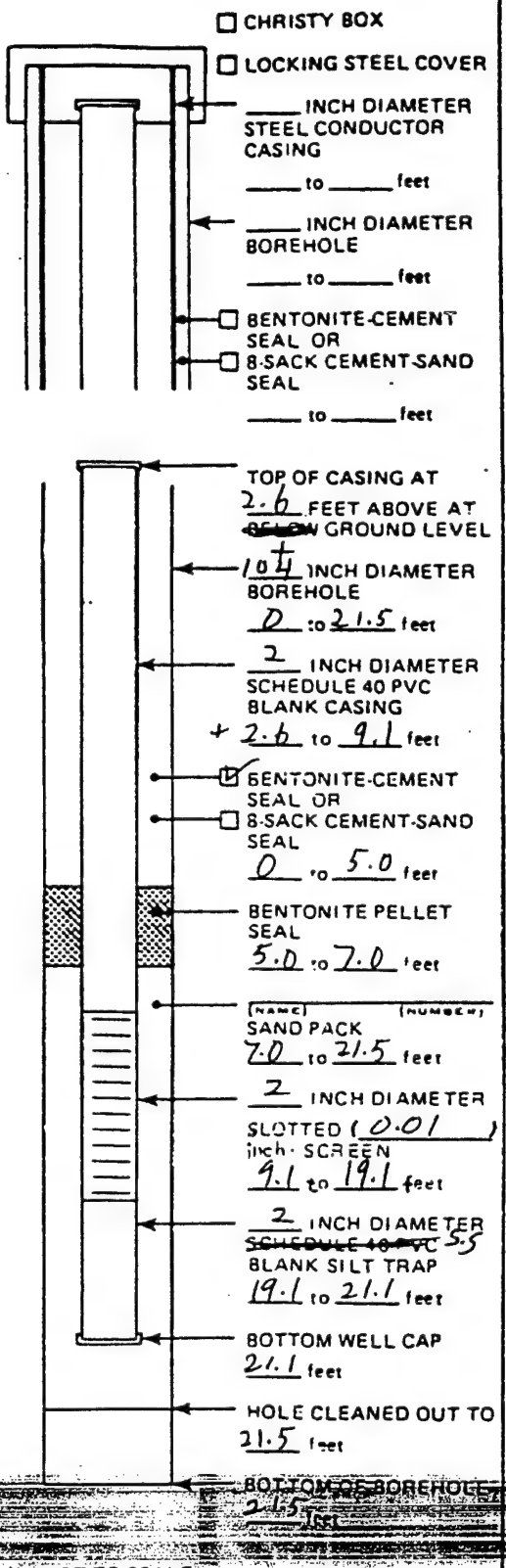
____ YARD³ CEMENT-SAND (REDI-MIX) ORDERED

____ YARD³ CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☐ NO ☐ YES

NAME ____

WELL COVER USED: ☐ LOCKING STEEL COVER ☐ CHRISTY BOX ☐ OTHER ____



ADDITIONAL INFORMATION: ____

Halliburton NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Eaker AFB

JOB NUMBER: 0114 | PROJECT MANAGER: AJ

LOGGED BY: BDH | EDITED BY:

WELL NAME: MW206 | DATE: 4/12/95

DRILLING COMPANY: Tri-State Testing

EQUIPMENT: ☑ 14 ID INCH HOLLOW STEM AUGER | DRILLER: Joe Hogge

☐ _____ INCH ROTARY WASH | HOURS DRILLED:

GALLONS OF WATER USED DURING DRILLING: NA GALLONS NA

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Clean

DEVELOPMENT

METHOD OF DEVELOPMENT:

DEVELOPMENT BEGAN DATE: TIME:

YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER _____

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

10½ SACKS OF 50lb 20/40 Morie SAND

_____ SACKS OF _____ CEMENT

_____ GALLONS OF GROUT USED

_____ SACKS OF POWDERED BENTONITE

100 POUNDS OF BENTONITE PELLETS

13.5 FEET OF 2 INCH PVC BLANK CASING

10.0 FEET OF 2 INCH PVC SLOTTED SCREEN

2.0 feet of 2 inch 5.5 silt trap

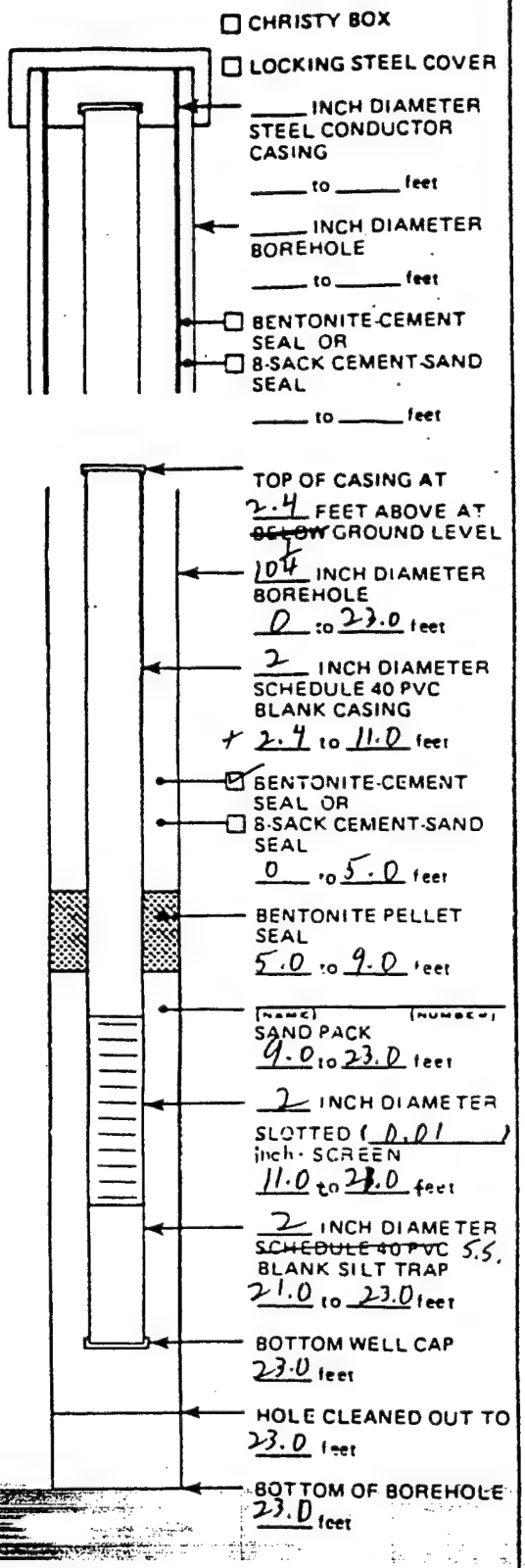
_____ YARD³ CEMENT-SAND (REDI-MIX) ORDERED

_____ YARD³ CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☐ NO ☐ YES

NAME _____

WELL COVER USED: ☐ LOCKING STEEL COVER ☐ CHRISTY BOX ☐ OTHER _____



NOT TO SCALE

ADDITIONAL INFORMATION: _____

Halliburton NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Eaker AFB

JOB NUMBER: 0114 | PROJECT MANAGER: AJ

LOGGED BY: BDH | EDITED BY:

WELL NAME: MW207 | DATE: 4/10/95

DRILLING COMPANY: Tri-State Testing

EQUIPMENT: ☑ 7 1/4 ID INCH HOLLOW STEM AUGER ☐ ____ INCH ROTARY WASH | DRILLER: Joe Flagler | HOURS DRILLED:

GALLONS OF WATER USED DURING DRILLING: NA GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Clean

DEVELOPMENT

METHOD OF DEVELOPMENT:

DEVELOPMENT BEGAN DATE: TIME:

YIELD:	TIME: FROM	TO	DATE:
____ GPM			
____ GPM			
____ GPM			
____ GPM			

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

9 1/2 SACKS OF 50/b 20/40 mone SAND

____ SACKS OF ____ CEMENT

____ GALLONS OF GROUT USED

____ SACKS OF POWDERED BENTONITE

75 POUNDS OF BENTONITE PELLETS

14.1 FEET OF 2 INCH PVC BLANK CASING

10.0 FEET OF 2 INCH ~~PVC~~ 5.5. SLOTTED SCREEN

2.0 feet of 2 inch 5.5. silt trap

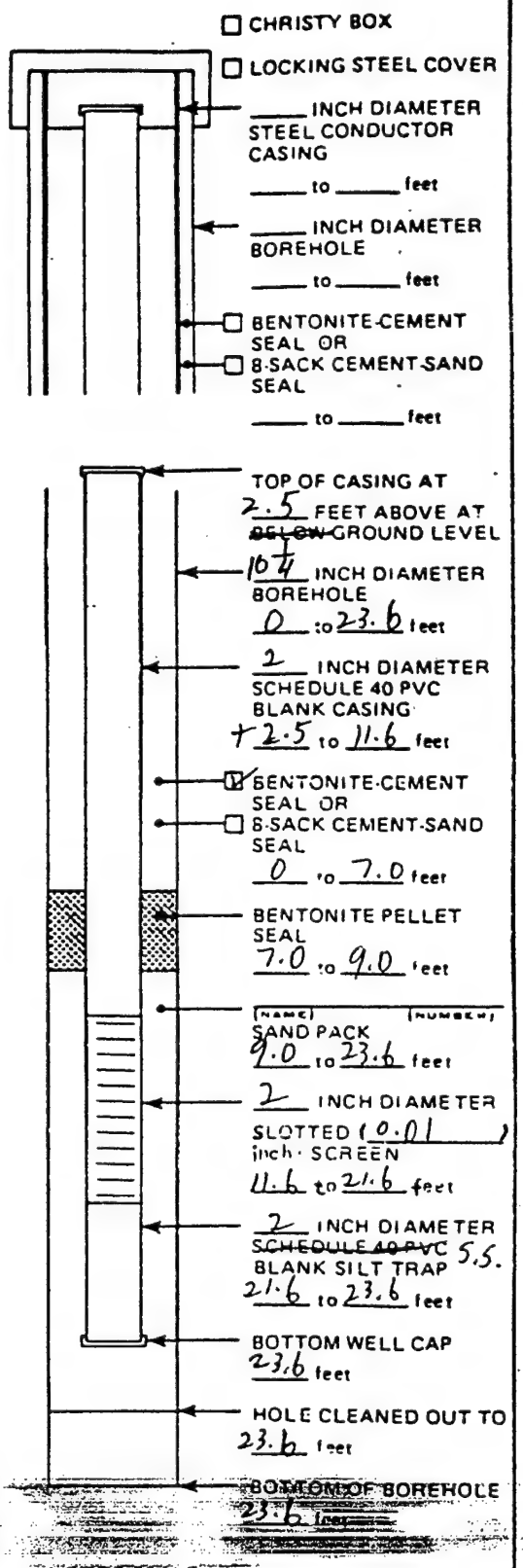
____ YARD^3 CEMENT-SAND (REDI-MIX) ORDERED

____ YARD^3 CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☐ NO ☐ YES

NAME ____

WELL COVER USED: ☐ LOCKING STEEL COVER ☐ CHRISTY BOX ☐ OTHER ____



NOT TO SCALE

ADDITIONAL INFORMATION: ____

Halliburton NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Eaker AFB

JOB NUMBER: 0114 | PROJECT MANAGER: Allan Jenkins

LOGGED BY: G. Millar | EDITED BY:

WELL NAME: MW 211 | DATE: 8/15/95

DRILLING COMPANY: Tri State Testing Services

EQUIPMENT: ☑ 10 INCH HOLLOW STEM AUGER ☐ ____ INCH ROTARY WASH | DRILLER: J. Crawford | HOURS DRILLED:

GALLONS OF WATER USED DURING DRILLING: GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Cleaning

DEVELOPMENT Well Development Form

METHOD OF DEVELOPMENT:

DEVELOPMENT BEGAN DATE: TIME:

YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

072495 GA DONNELL

11 SACKS OF Morie 2040 Filtration Media SAND

____ SACKS OF ____ CEMENT

20 GALLONS OF GROUT USED

____ SACKS OF POWDERED BENTONITE

~~75 0150 lbs~~ POUNDS OF BENTONITE PELLETS 1 1/2 buckets

15 FEET OF 2 INCH PVC BLANK CASING w/ 2.5 ft. cutoff.

10 FEET OF 2 INCH ~~PVC~~ S.S. SLOTTED SCREEN

2 FT of 2 inch S.S. silt trap

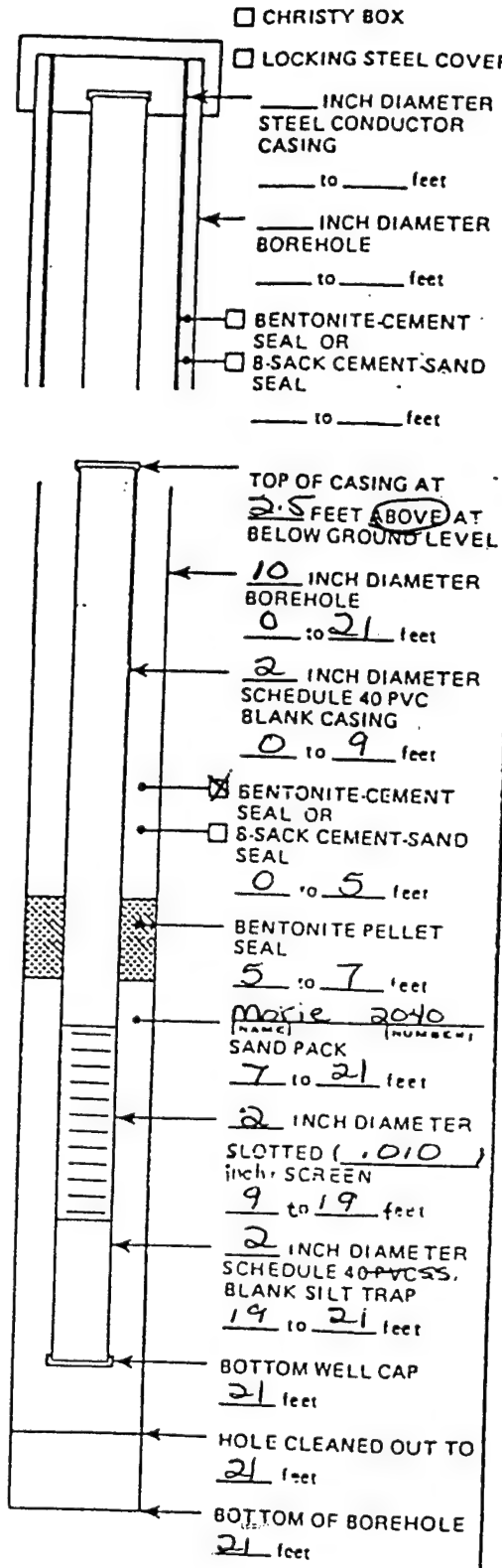
____ YARD^3 CEMENT-SAND (REDI-MIX) ORDERED

____ YARD^3 CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☒ NO ☐ YES

NAME mixed in a 55 gal.

WELL COVER USED: ☒ LOCKING STEEL COVER ☐ CHRISTY BOX ☐ OTHER ____



NOT TO SCALE

ADDITIONAL INFORMATION: ____

Calculated sand = 10.92 sacks

Calculated grout = 19.6 gal

Halliburton NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Eaker AFB

JOB NUMBER: 0114 | PROJECT MANAGER: Allan Jenkins

LOGGED BY: G. Millar | EDITED BY:

WELL NAME: TW1501 | DATE: 8/27/95

DRILLING COMPANY: Tri State Testing Services

EQUIPMENT: ☑ 7¼ INCH HOLLOW STEM AUGER | DRILLER: M. Tothy

☐ ____ INCH ROTARY WASH | HOURS DRILLED:

GALLONS OF WATER USED DURING DRILLING: 5 GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Cleaning

DEVELOPMENT See Well Development Form

METHOD OF DEVELOPMENT:

DEVELOPMENT BEGAN DATE: TIME:

YIELD: ____ GPM	TIME: FROM ____ TO ____	DATE:	
YIELD: ____ GPM	TIME: FROM ____ TO ____	DATE:	
YIELD: ____ GPM	TIME: FROM ____ TO ____	DATE:	
YIELD: ____ GPM	TIME: FROM ____ TO ____	DATE:	

TOTAL WATER REMOVED DURING DEVELOPMENT: ____ GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

DEPTH TO WATER AFTER DEVELOPMENT: ____ FEET

MATERIALS USED

5 3/4 SACKS OF ____ SAND

NA SACKS OF ____ CEMENT

NA GALLONS OF GROUT USED

NA SACKS OF POWDERED BENTONITE

75 POUNDS OF BENTONITE PELLETS 1.5 buckets

10 FEET OF 2 INCH PVC BLANK CASING 1 Ft of cut off.

10 FEET OF 2 INCH PVC SLOTTED SCREEN

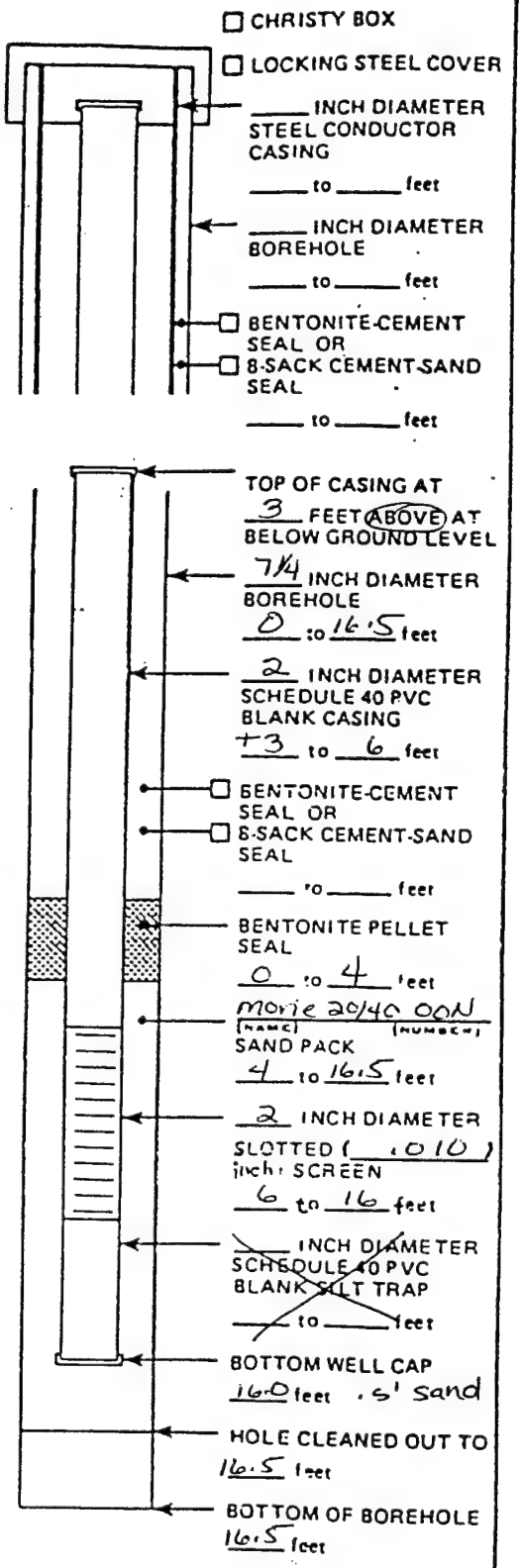
____ YARD^3 CEMENT-SAND (REDI-MIX) ORDERED

____ YARD^3 CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☒ NO ☐ YES

NAME ____

WELL COVER USED: ☐ LOCKING STEEL COVER ☐ CHRISTY BOX ☒ OTHER Temp Well



NOT TO SCALE

ADDITIONAL INFORMATION: calculated sand = 6.25 bags

Halliburton NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: EAKER AFB

JOB NUMBER: 0114 | PROJECT MANAGER: ALLAN JENKINS

LOGGED BY: B. McCANLESS | EDITED BY:

WELL NAME: TW1502 | DATE: 8/28/95

DRILLING COMPANY: TRI STATE TESTING

EQUIPMENT: ☑ 7 1/4 INCH HOLLOW STEM AUGER | DRILLER: M. TOTTY

☐ _____ INCH ROTARY WASH | HOURS DRILLED: 1

GALLONS OF WATER USED DURING DRILLING: 5 GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: STEAM CLEAN

DEVELOPMENT

METHOD OF DEVELOPMENT: SEE DEVELOPMENT FORM

DEVELOPMENT BEGAN DATE: TIME:

YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER _____

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

5 SACKS OF MORIE CO. FILTRATION MEDIA SAND

NA SACKS OF _____ CEMENT

NA GALLONS OF GROUT USED

NA SACKS OF POWDERED BENTONITE

87 POUNDS OF BENTONITE PELLETS 1.34 BUCKETS

10 FEET OF 2 INCH PVC BLANK CASING

10 FEET OF 2 INCH PVC SLOTTED SCREEN

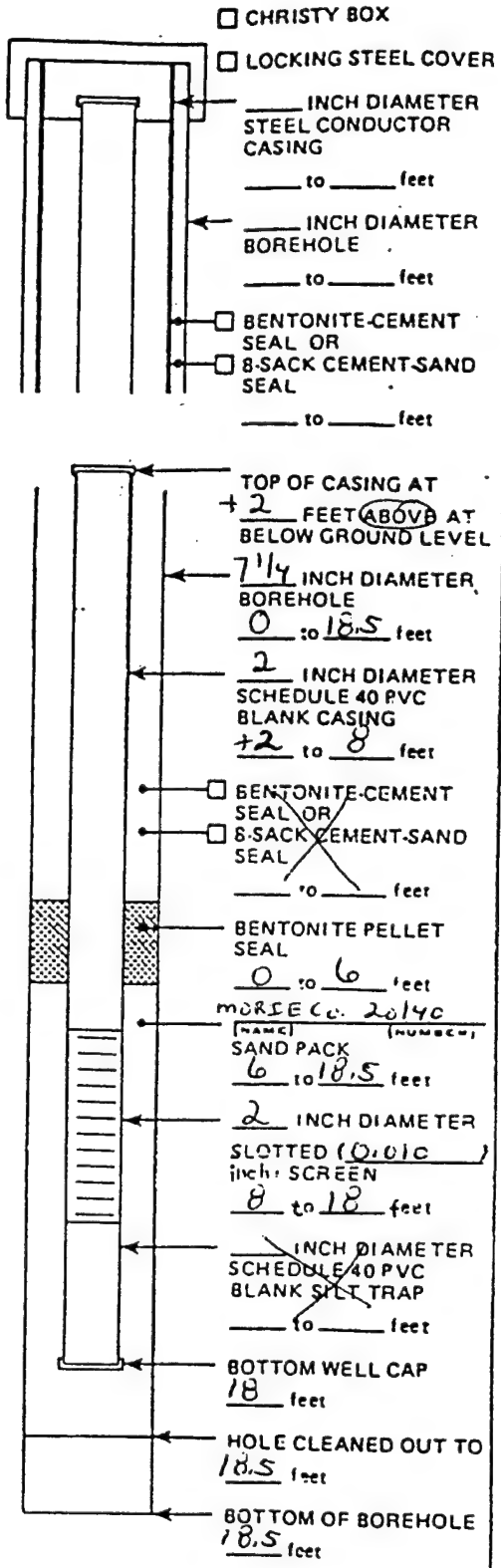
_____ YARD^3 CEMENT-SAND (REDI-MIX) ORDERED

_____ YARD^3 CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☑ NO ☐ YES

NAME _____

WELL COVER USED: ☐ LOCKING STEEL COVER ☐ CHRISTY BOX ☑ OTHER TEMPORARY WELL



NOT TO SCALE

ADDITIONAL INFORMATION: CALCULATED SAND = 6.25 BAGS

Halliburton NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Eaker AFB

JOB NUMBER: 0114 | PROJECT MANAGER: Allan Jenkins

LOGGED BY: G. Millar | EDITED BY:

WELL NAME: TW1503 | DATE: 8/27/95

DRILLING COMPANY: Tri State Testing Services

EQUIPMENT: ☑ 7¼ INCH HOLLOW STEM AUGER ☐ ____ INCH ROTARY WASH | DRILLER: M. Totty | HOURS DRILLED:

GALLONS OF WATER USED DURING DRILLING: 5 GALLONS to hydrate

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Cleaning

DEVELOPMENT See Well Development Form

METHOD OF DEVELOPMENT:

DEVELOPMENT BEGAN DATE: TIME:

YIELD: ____ GPM	TIME: FROM ____ TO ____	DATE:	
YIELD: ____ GPM	TIME: FROM ____ TO ____	DATE:	
YIELD: ____ GPM	TIME: FROM ____ TO ____	DATE:	
YIELD: ____ GPM	TIME: FROM ____ TO ____	DATE:	

TOTAL WATER REMOVED DURING DEVELOPMENT: ____ GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

DEPTH TO WATER AFTER DEVELOPMENT: ____ FEET

MATERIALS USED

5 1/16 SACKS OF Morie 20/40 Filtration media SAND 072495 GA OGNWELL

____ SACKS OF ____ CEMENT

____ GALLONS OF GROUT USED

____ SACKS OF POWDERED BENTONITE

75 POUNDS OF BENTONITE PELLETS 1 1/2 buckets

10 FEET OF 2 INCH PVC BLANK CASING 1.5' cut off

10 FEET OF 2 INCH PVC SLOTTED SCREEN

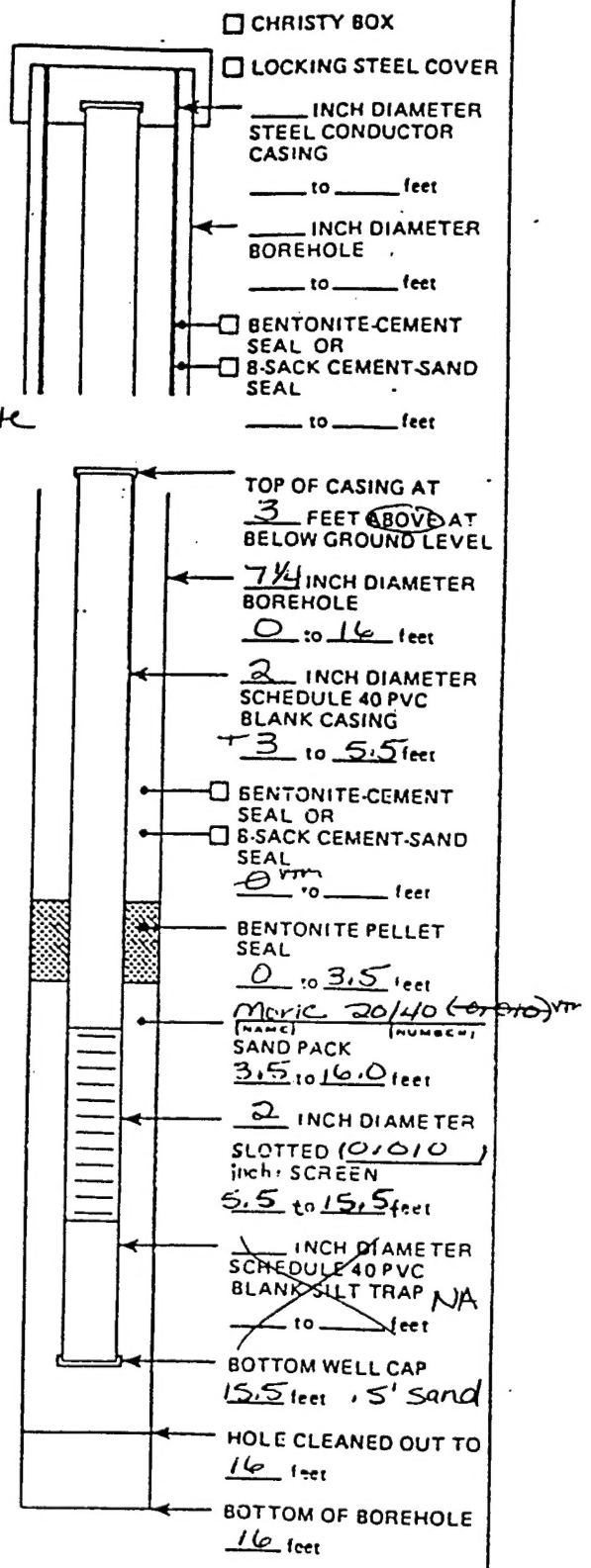
____ YARD³ CEMENT-SAND (REDI-MIX) ORDERED

____ YARD³ CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☒ NO ☐ YES

NAME ____

WELL COVER USED: ☐ LOCKING STEEL COVER ☐ CHRISTY BOX ☒ OTHER Temp Well



NOT TO SCALE

ADDITIONAL INFORMATION: ____

Calculated Sand = 6.12 sacks

Halliburton NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: EAKER AFB

JOB NUMBER: 0114 | PROJECT MANAGER: ALLAN JENKINS

LOGGED BY: B. McCANLESS | EDITED BY:

WELL NAME: TW1504 | DATE: 8/27/95

DRILLING COMPANY: TRISTATE TESTING

EQUIPMENT: ☑ 7 1/4 INCH HOLLOW STEM AUGER | DRILLER: M. TOTTY

☐ _____ INCH ROTARY WASH | HOURS DRILLED:

GALLONS OF WATER USED DURING DRILLING: 8 GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: STEAM CLEAN

DEVELOPMENT

METHOD OF DEVELOPMENT: SEE DEVELOPMENT FORM

DEVELOPMENT BEGAN DATE: TIME:

YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:
YIELD: GPM	TIME: FROM	TO	DATE:

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER _____

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

4 SACKS OF MORIE CO. FILTRATION MEDIA SAND

NA SACKS OF _____ CEMENT

NA GALLONS OF GROUT USED

NA SACKS OF POWDERED BENTONITE

75 POUNDS OF BENTONITE PELLETS 1.5 BUCKETS

10 FEET OF 2 INCH PVC BLANK CASING 1.5' CUTOFF

10 FEET OF 2 INCH PVC SLOTTED SCREEN

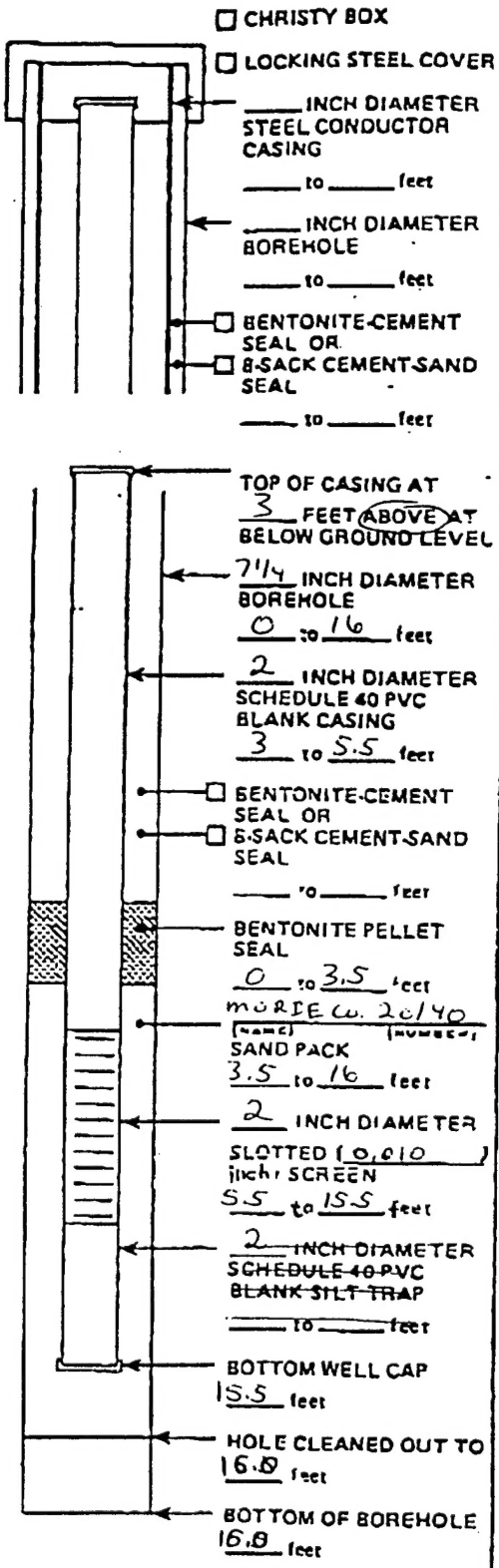
_____ YARD^3 CEMENT-SAND (REDI-MIX) ORDERED

_____ YARD^3 CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☑ NO ☐ YES

NAME _____

WELL COVER USED: ☐ LOCKING STEEL COVER ☐ CHRISTY BOX ☑ OTHER TEMPORARY WELL



NOT TO SCALE

ADDITIONAL INFORMATION: CALCULATED SAND= 6.25 BAGS

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: EAKER AFB 410 Area

JOB NUMBER: 3698 PROJECT MANAGER: GVB

LOGGED BY: JSB REVIEWED BY: BFN

WELL NAME: MW1202 DATE: 1-7-92

DRILLING COMPANY: A W POOL

EQUIPMENT: [X] 6¼ INCH HOLLOW STEM AUGER DRILLER: V. Barnes

[ ] _____ INCH ROTARY WASH HELPER (DRILLER): _____

GALLONS OF WATER USED DURING DRILLING: NONE GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Pressure Steam

DEVELOPMENT

METHOD OF DEVELOPMENT: _____

DEVELOPMENT BEGAN (DATE): _____ TIME: _____

YIELD: _____ GPM TIME: FROM _____ TO _____ DATE: _____

YIELD: _____ GPM TIME: FROM _____ TO _____ DATE: _____

YIELD: _____ GPM TIME: FROM _____ TO _____ DATE: _____

YIELD: _____ GPM TIME: FROM _____ TO _____ DATE: _____

TOTAL WATER REMOVED DURING DEVELOPMENT: _____ GALLONS

DESCRIPTION OF CLARITY AT END OF DEVELOPMENT: [ ] CLEAR [ ] SLIGHTLY CLOUDY [ ] MOD. TURBID [ ] VERY MUDDY

ODOR OF WATER: _____

WATER DISCHARGED TO: [ ] GROUND SURFACE [ ] TANK TRUCK [ ] STORM SEWERS [ ] STORAGE TANK [ ] DRUMS [ ] OTHER _____

DEPTH TO WATER AFTER DEVELOPMENT: _____ FEET

MATERIALS USED

2 100# SACKS OF 20/40 Colorado Silica SAND

_____ SACKS OF _____ CEMENT

_____ GALLONS OF GROUT USED

50 lbs SACKS OF POWDERED BENTONITE

50 POUNDS OF BENTONITE PELLETS

5 FEET OF 2 INCH PVC BLANK CASING

10 FEET OF 2 INCH PVC SLOTTED SCREEN

2 FEET OF 2 inch PVC SLOTTED SLEEVE

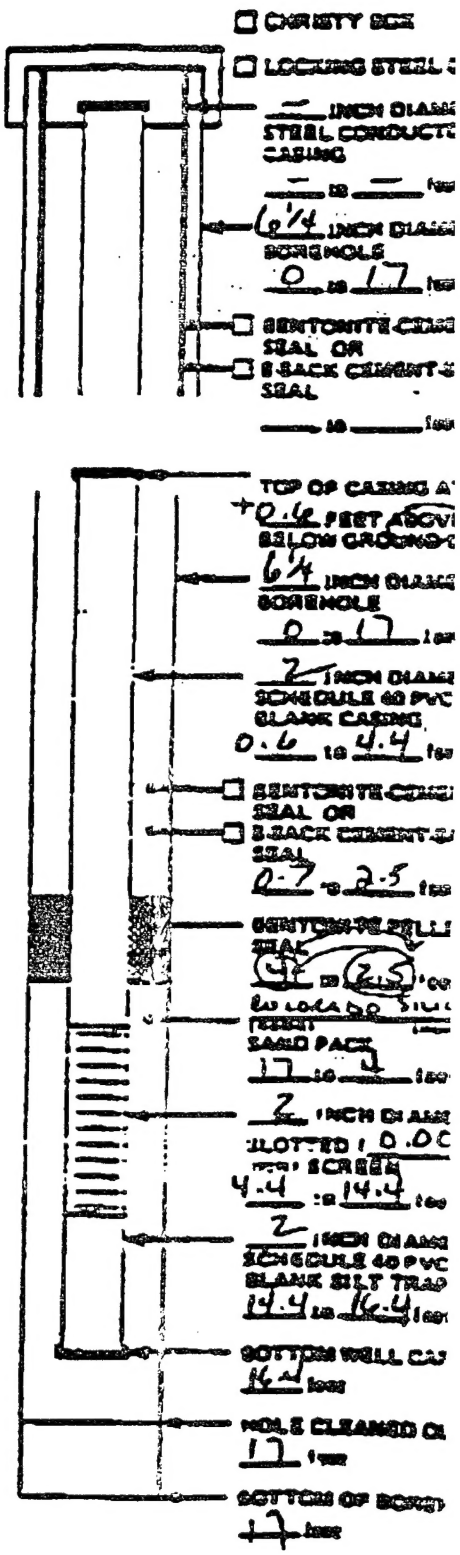
_____ YARD³ CEMENT-SAND (GROUT) GROUTED

_____ YARD³ CEMENT-SAND (GROUT) USED

CONCRETE PLUG(S) USED? [X] NO [ ] YES

SIZE: _____

WELL COVER USED: [ ] LOCKING STEEL CAP [ ] SECURITY BOX [ ] OTHER _____



NOT TO SCALE

ADDITIONAL INFORMATION: _____

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: EAKER AFB

JOB NUMBER: 3K9B | PROJECT MANAGER: GVG

LOGGED BY: BFN | ENTERED BY:

WELL NAME: MW203 | DATE: 1-7-92

DRILLING COMPANY: POOL DRILLING

EQUIPMENT: ☐ 6¼ INCH HOLLOW STEM AUGER | DRILLER: V. BAZAR220

☐ _____ INCH ROTARY WASH | HRS/DAY DRILLED: .43

GALLONS OF WATER USED DURING DRILLING: GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: HIGH PRESSURE STEM

DEVELOPMENT

METHOD OF DEVELOPMENT:

DEVELOPMENT BEGAN DATE: TIME:

YIELD:	GPM	TIME: FROM	TO	DATE:
YIELD:	GPM	TIME: FROM	TO	DATE:
YIELD:	GPM	TIME: FROM	TO	DATE:
YIELD:	GPM	TIME: FROM	TO	DATE:

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

COLOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

2 SACKS OF 20/40 Silica Grade SAND

_____ SACKS OF _____ CEMENT

_____ GALLONS OF GROUT USED

_____ SACKS OF POWDERED BENTONITE

50 POUNDS OF BENTONITE PELLETS

5 FEET OF 2 INCH PVC BLANK CASING

10 FEET OF 2 INCH PVC SLOTTED SCREEN

2 " " 2 " w/ SUMP

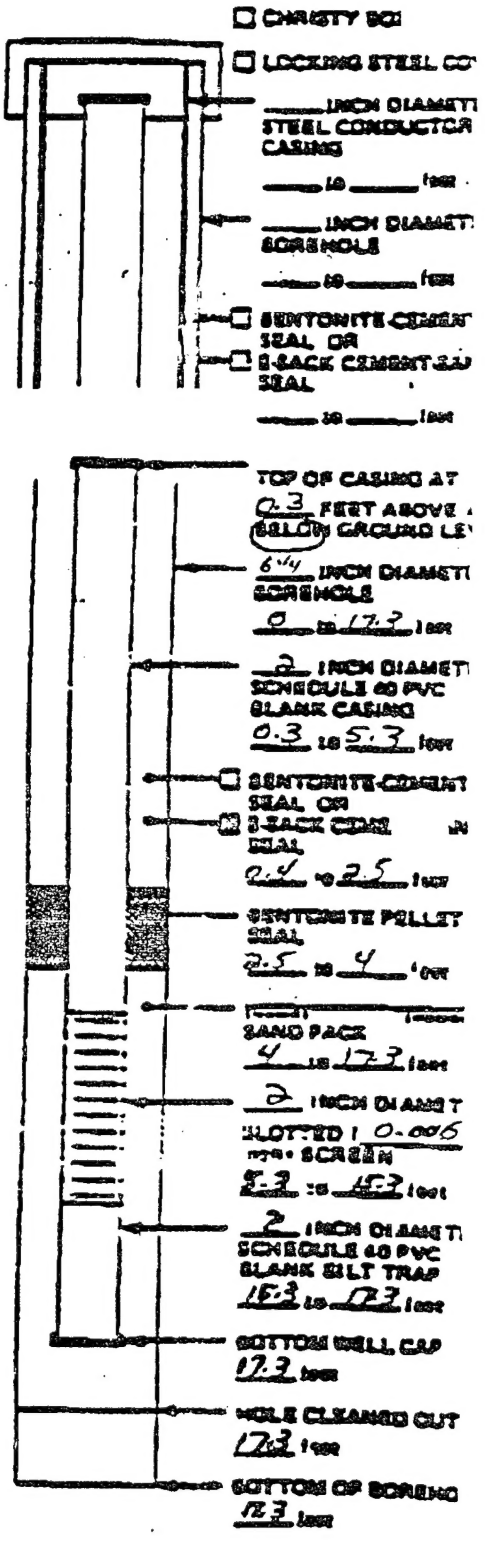
_____ YARD³ CEMENT-SAND (NEAT-MIX) ORDERED

_____ YARD³ CEMENT-SAND (NEAT-MIX) USED

CONCRETE PUMPER USED? ☐ NO ☐ YES

NAME: _____

WELL COVER USED: ☐ LOCKING STEEL COVER ☐ CHRISTY BOX ☐ OTHER _____



NOT TO SCALE

ADDITIONAL INFORMATION: _____